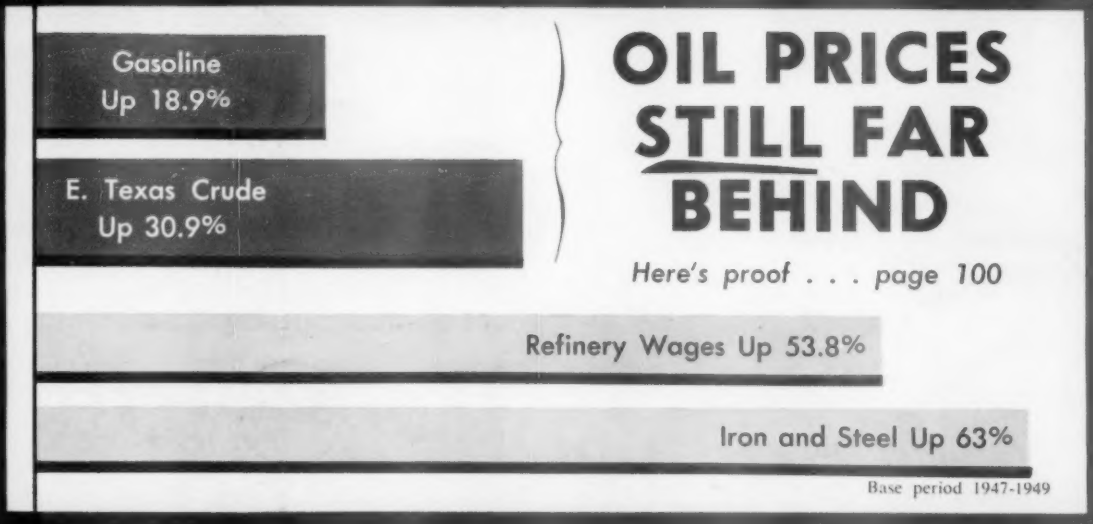
the OIL AND GAS JOURNAL

FEBRUARY 18, 1957

Today and tomorrow in-

PROCESS AUTOMATION

A 16-PAGE REPORT COMPLETE IN THIS ISSUE
STARTS PAGE 121



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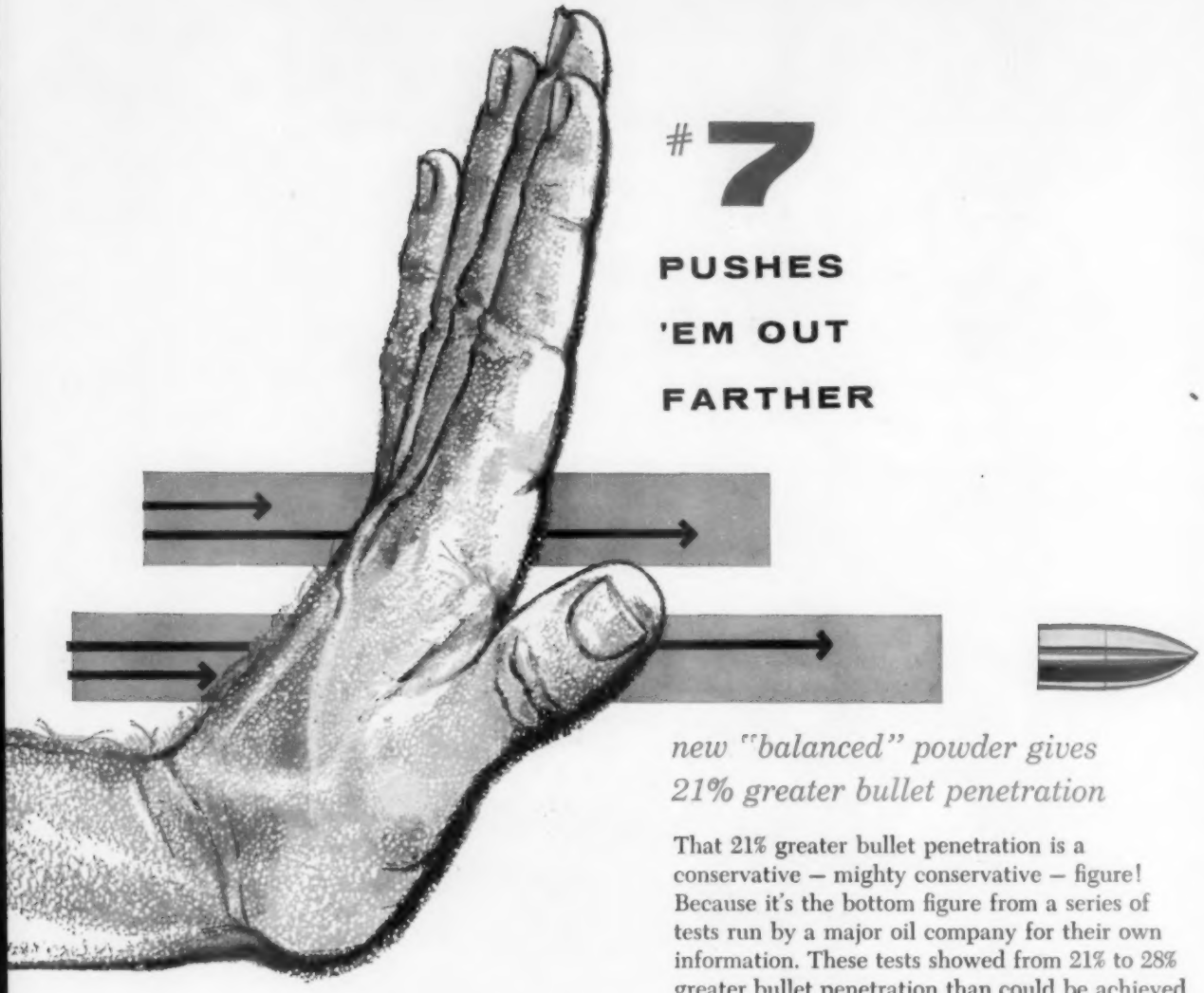

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A Glance Ahead

- **Don't count West Texas out** of the picture for new refineries. One big company is firming up plans now for building a sizable plant in that region. Its announcement should come within the next few weeks.

- **Oklahoma has a promising potential oil region** in the southern section of the state. Watch for exploratory work to hum throughout the region in 1957.

  The area includes 500,000 acres between Caddo in Carter County and Cumberland in Bryan County. Thick, multipay Ordovician sands at Cumberland, Madill, and Ardmore promise good rewards. Geophysical programs carried out over the past months have turned up some highly favorable drilling areas. Strangely, depths of the Ordovician go from 2,000 to 14,000 ft.

- **Puerto Rico stands a good chance to boost** its infant standing as a refining center. One major oil company reportedly is seriously considering a new plant on the island. It would process Venezuelan crude for the U. S. East Coast market. Of the two refineries there now, one is being expanded to more than double present capacity. Total capacity on the island should exceed 72,000 bbl. daily by fall.

- **Tightness of steel pipe market is sparking** renewed interest in plastics in the oil country. Aluminum also is sharing in this new interest. Necessity is mothering several test installations which weren't considered when plenty of steel was available for line pipe.

- **Seagoing geophysical crews are proving their worth.** Their speed and economy in evaluating many geological areas extending under the sea are bright pages in the story of offshore operations.

  Actually, water crews cost more to operate, but their daily output is 5 to 20 times greater than that of a land crew. Some Gulf Coast crews, for instance, have turned out as many as 200 profiles in a day. This is the normal monthly output for a land crew working in the Mid-Continent.

- **Buckled tubing in rod-pumped wells** is getting a lot more attention from producers. They are just beginning to understand the phenomenon and the chain of excessive costs it sets off. It causes rod-on-tubing wear, puts excessive loads on rods, horsepower, and pumps. Prospects are the industry soon will form an A.P.I. committee to organize a study of the subject and come up with preventive measures to reduce its cost.

- **Refiners are finding improved deasphalting** can reduce treating costs. Humble turned the trick by deasphalting at a higher solvent-to-oil ratio and using a tower rather than a drum. This cut acid treating of the lube residuum by about 80 per cent.

  Humble has turned up another cost cutter: Pollution prevention. In all its future projects where contaminants are anticipated, facilities to remove them will be included as an integral part of the project.

- **Higher interest rates are sounding the death knell** to some capital expansions planned this year. And the tight money market has had a major influence on designing some new projects which got the go-ahead. The watchword is: Build it cheap.

the OIL AND GAS JOURNAL

FEBRUARY 18, 1957 • VOLUME 55 • NUMBER 7

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OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
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TECHNOLOGY–OPERATION

Drilling-Production

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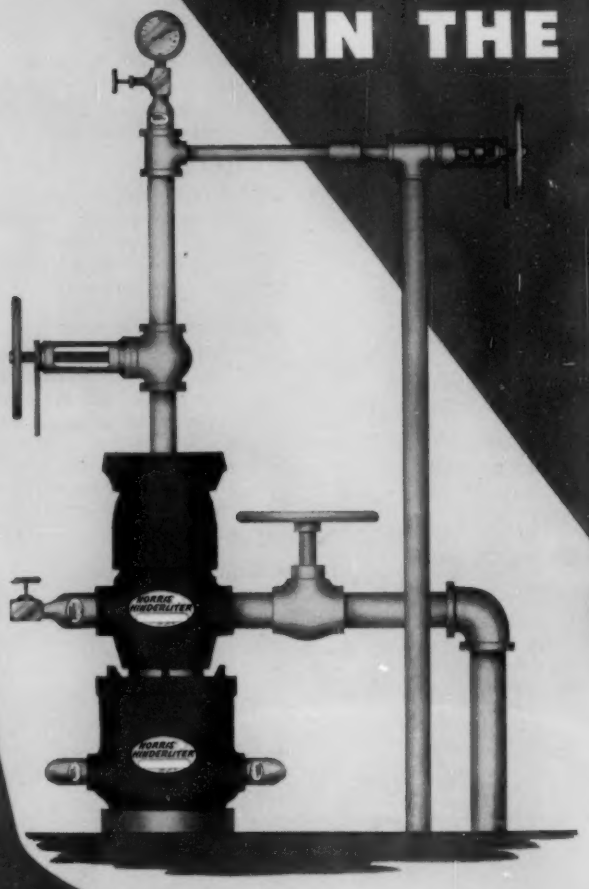
Finest

IN THE FIELD



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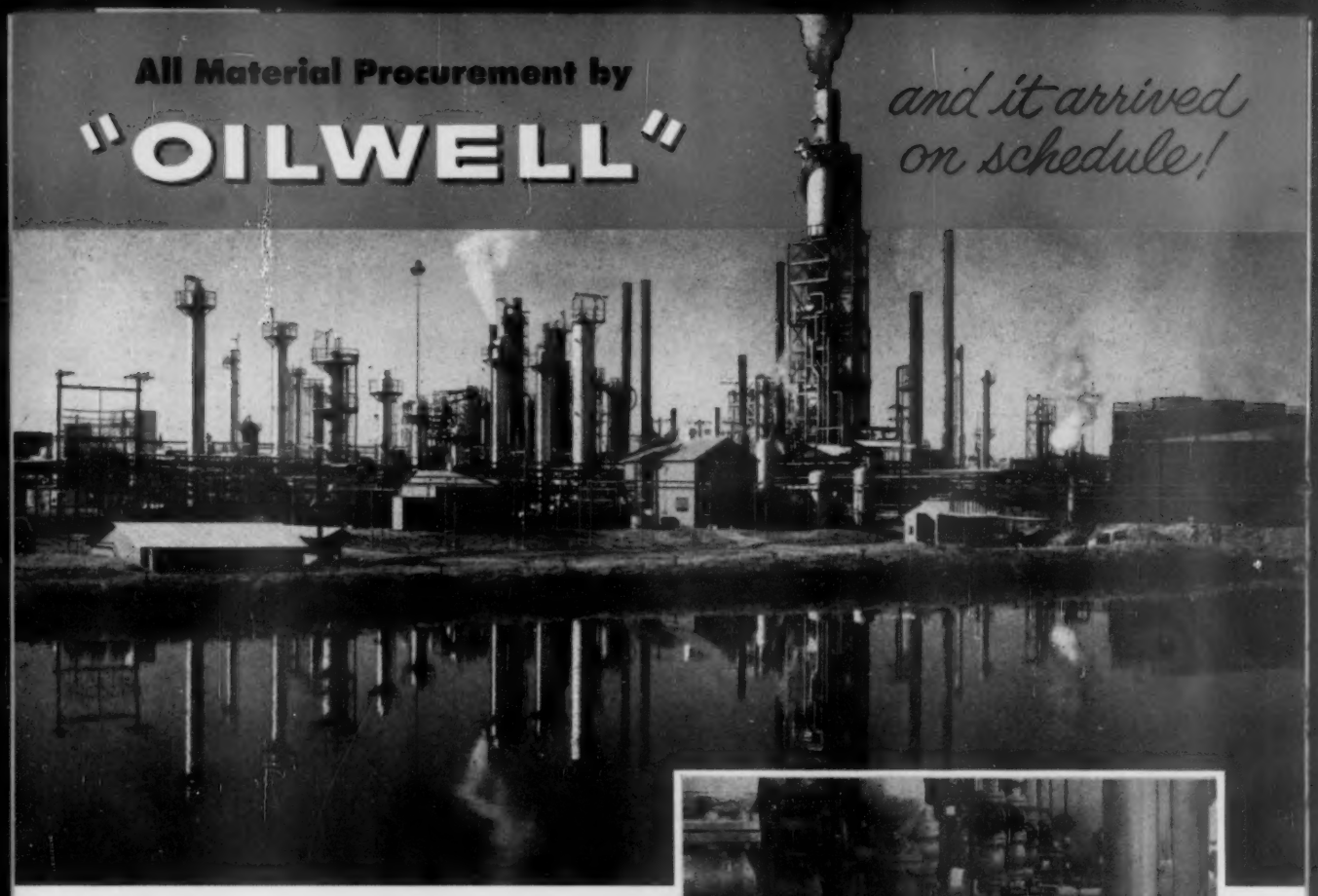

NEW CONSTRUCTION involves problems of procurement and expediting, as well as design and erection. But American Liberty Oil Company, Mt. Pleasant, Texas, avoided all this when they modernized their 5,000 b/d thermal cracking facilities and added a new 6,000 b/d catalytic cracking unit.

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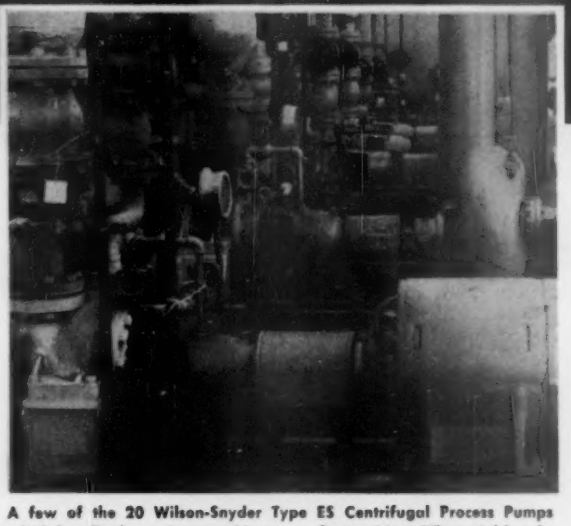

A few of the 20 Wilson-Snyder Type ES Centrifugal Process Pumps which handle the various combinations of capacities, differential heads, specific gravities and temperatures involved in this installation. Wide interchangeability of parts results in minimum inventory requirements.

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New Water Line, which will treble present supply to Lenoir, N. C., consists of 50-foot lengths of steel pipe, lined and coated with Bitumastic No. 70-B AWWA Enamel. The Koppers Contract Coating Department set up complete field cleaning, lining and coating facilities at the job site. Coal-tar enamel linings are the only type allowed in the recommended specifications of the American Water Works Association. Coal-tar coatings are the only materials which field experience has proved can resist water and provide high electrical resistance over long periods of time.

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how to
CUT CORROSION LOSSES
a report by Koppers Company, Inc.

Number 7 of a series

F. P. Filer
Project Leader

In this Corrosion Report, we would like to explore the functions of primers and the contribution which they can make toward the success of protective coating systems. While every step in a protective coating system is important, from precoating survey to finished coating, one of the more important is priming.

* * *

Basically, primers have one specific function: to bond intermediate and finish coats to the metal surface. To perform this function properly, it is vitally important that the primer be compatible with the intermediate and finish coats.

* * *

While priming is used with most protective coatings—with the exception of certain proprietary coal-tar coatings—no primer can compensate for incomplete surface preparation. The Steel Structures Painting Manual states specifically, "Any primer sold on the basis that it eliminates the preparation of the surface should be viewed with extreme caution." Rust, dirt, grease, and loose scale should *always* be removed before priming. In some cases, primers are applied over tight mill scale in the shop. Good practice would dictate removal of scale before priming to obtain a long-lived coating system.

We have often been asked whether shop primers (applied by the metal fabricator) should be used. One disadvantage is that they sometimes become badly scratched in transit and require considerable touch-up on the job site. Other drawbacks are that shop primers may not provide protection for a sufficiently long period, and may be applied without regard to their compatibility with the field coating specified. Also, shop primers may cover up inadequate surface preparation jobs.

The following points should be considered before specifying shop primers: (1) corrosivity at the job site; (2) estimated time between shop priming and field coating; (3) compatibility with the coating.

* * *

The terms "wash primer" and "primer" should not be confused. A wash primer is not a true primer but an integral part of surface preparation. It does not take the place of a primer when priming is required. Sometimes, wash primers are specified for short-term protection before application of self-priming, cold-applied coal-tar coatings.

* * *

From an application standpoint, there are three characteristics of primers that are of importance: wetting ability, consistency, and drying time. Properly selected and applied, primers should provide a uniform, tightly-bonded film to which the coating system will adhere tenaciously.

* * *

Your comments on these Reports will be appreciated. If there are any specific questions which you have relating to corrosion control, write Koppers Company, Inc., 1450 Koppers Building, Dept. 104B, Pittsburgh 19, Pa. District Offices: Boston, Chicago, Los Angeles, New York, Pittsburgh and Woodward (Birmingham) Ala. In Canada: Koppers Products, Ltd., Toronto, Ontario, and Edmonton, Alberta.

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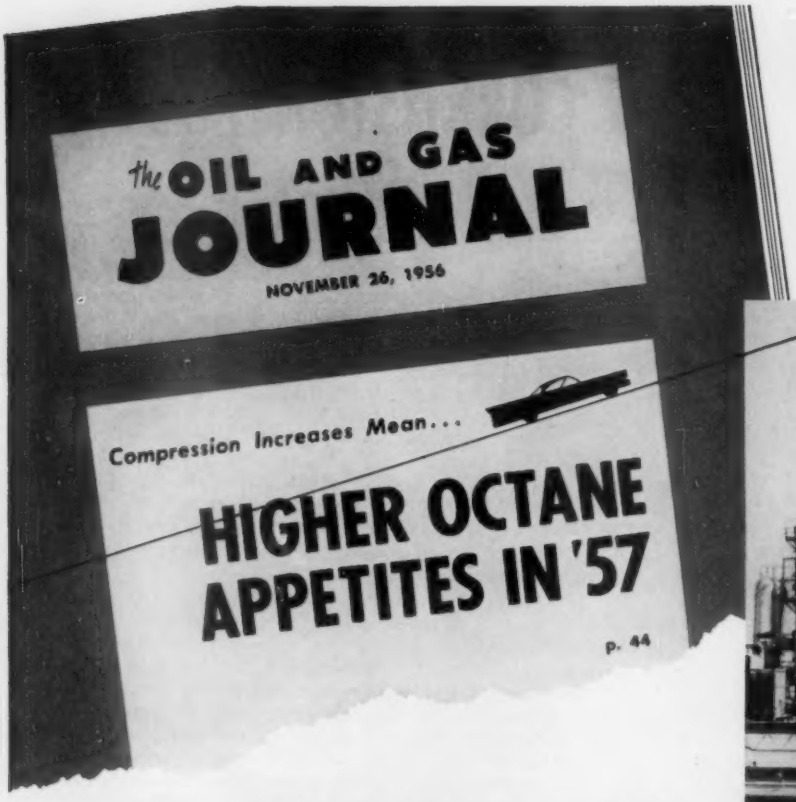

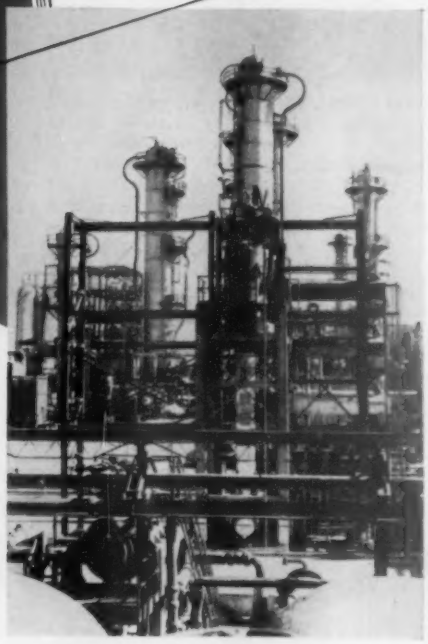

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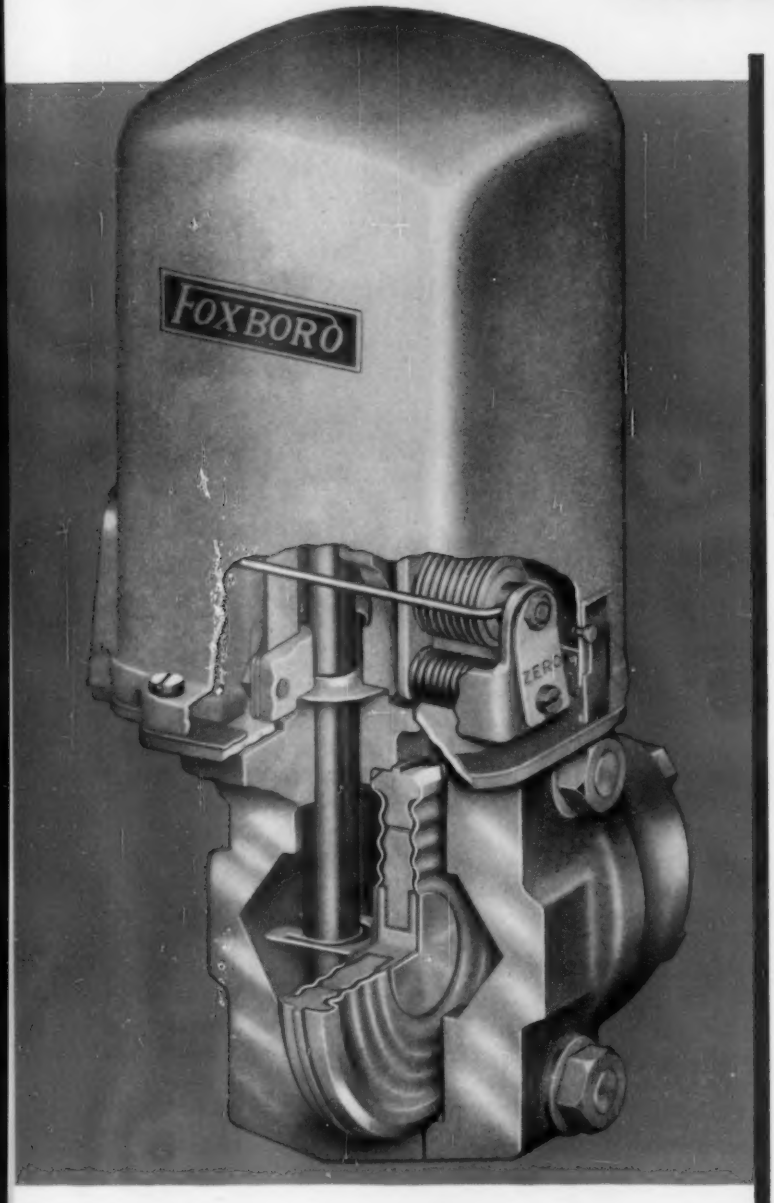

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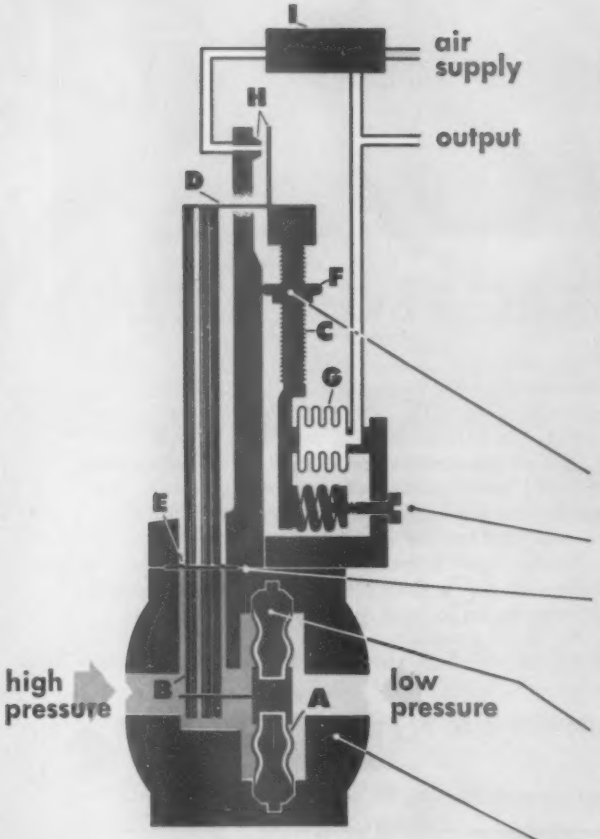
Cell Flow Transmitter

design features...



How It Works . . .

An increase in differential pressure across Twin-Diaphragm Capsule (A) exerts force to right on force bar (B). Elgiloy® diaphragm seal (E) acts as fulcrum. Force to left at top of bar (B) causes flapper to approach nozzle at (H). Resulting increase in nozzle pressure is amplified by relay (I). This pressure is sent to feedback bellows (G) which develops force to counterbalance the differential pressure on capsule (A). The 3-15 psi output signal from relay (I), always precisely proportional to differential pressure, is transmitted to remote recording or controlling instrument.

Range Wheel is continuously and easily adjustable for entire range whether 0-20" to 0-80" or 0-50" to 0-250" H_2O.

Easy-access screw adjustment permits field "zeroing" without removing weatherproof cover.

Elgiloy® stainless alloy diaphragm seal assures a corrosion-resistant, frictionless, positive pivot point. Instrument is constructed in 3 basic units — body, transmitter, and air relay block — eliminating all possibility of errors produced by piping stresses.

Silicone-filled Twin-Diaphragm Capsule filters out flow disturbances ("noise") at measurement source . . . without loss of speed of response. Precisely matched surfaces of diaphragms and capsule core provide "stops" which give positive overrange protection in both directions.

Rugged forged body, optionally Type 316 S.S. or carbon steel, gives greatest strength with least weight . . . ultra-compact design permits low cost mounting from flange taps.

FOXBORO
Reg. U.S. Pat. Off.

First in Flow Instrumentation

KEEP A KIDDE EXTINGUISHER NEAR EVERY HAZARD!

Move fast against fire the instant it strikes, and you can stop it with little damage. But let it get a head start, and you may lose your equipment, your buildings . . . or your life.

Be selective in your choice of fire extinguishing equipment. Choose Kidde! You can be certain of rugged construction, simple operation, and absolute dependability.

For more than thirty years, Kidde fire extinguishers have been built to the most exacting specifications, have passed the most rigorous of tests, have the highest ratings. There is not a better-made extinguisher on the market today.

In ease of operation Kidde extinguishers also stand unsurpassed. The trigger-release grip on Kidde carbon dioxide and dry chemical extinguishers is the fastest and most natural to use. With it, even inexperienced operators can move swiftly and confidently against a blaze, extinguishing flames in seconds. You simply aim the horn, pull the trigger, and fire's out. Models with squeeze valves available too.

Finally, there is the Kidde service organization. In cities everywhere there are trained Kidde representatives who are ready to service your extinguishers.

For more information about the complete line of Kidde extinguishers, write for Kidde's P-8 Catalog.

Walter Kidde & Company, Inc. 254 Main St., Belleville 9, N. J.

Walter Kidde & Company of Canada Ltd., Montreal—Toronto

Kidde

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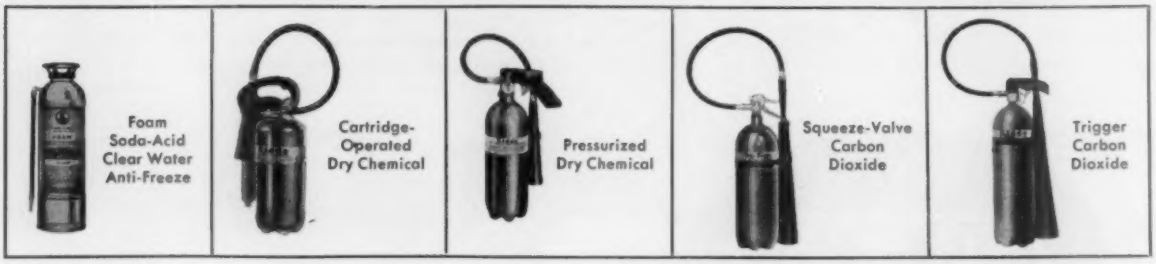
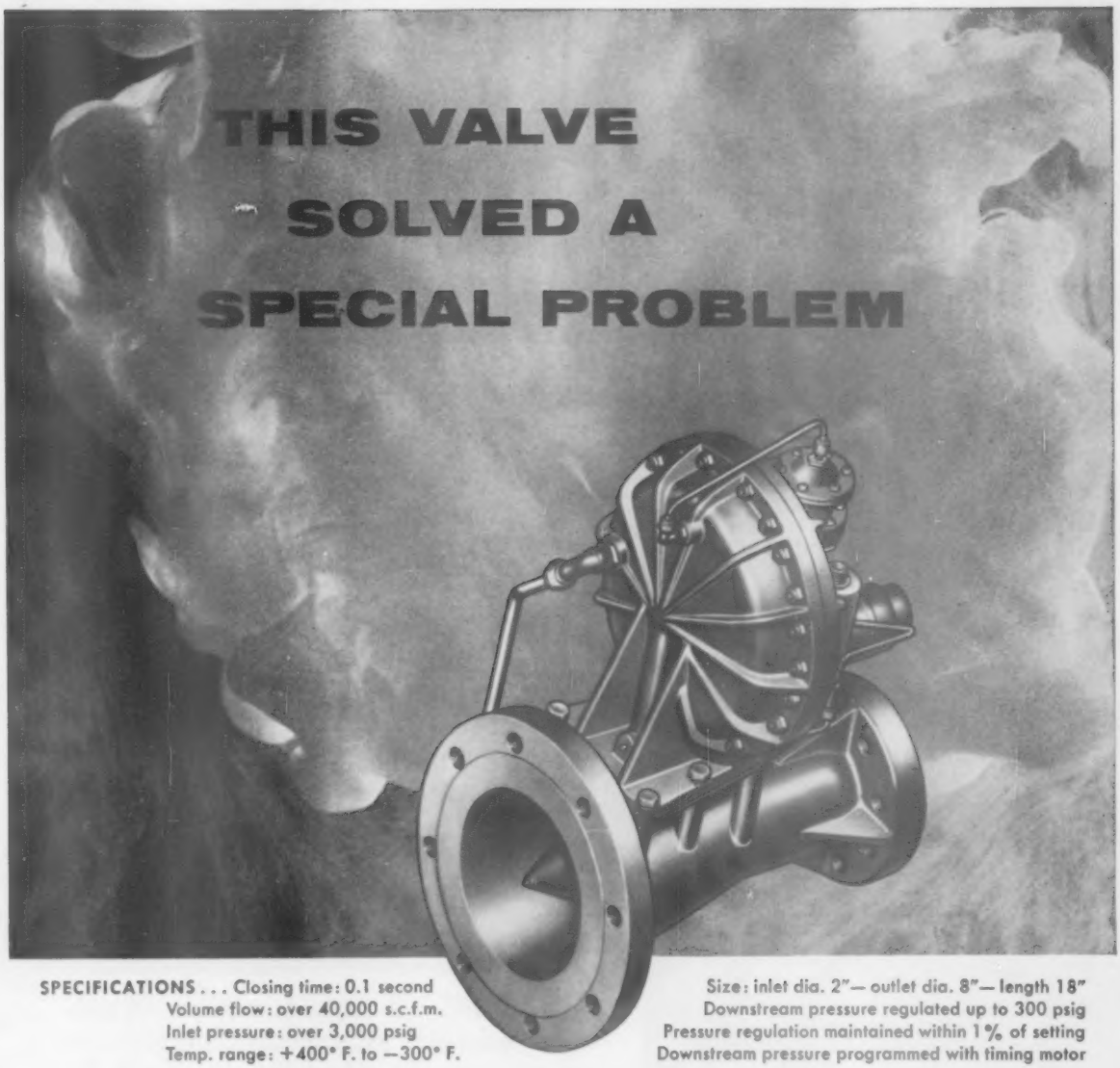




SPECIFICATIONS . . . Closing time: 0.1 second
Volume flow: over 40,000 s.c.f.m.
Inlet pressure: over 3,000 psig
Temp. range: +400° F. to −300° F.

Size: inlet dia. 2"— outlet dia. 8"— length 18"
Downstream pressure regulated up to 300 psig
Pressure regulation maintained within 1% of setting
Downstream pressure programmed with timing motor

Fifteen years of AiResearch experience in engineering and fabrication of valves for special applications went into this design.

As you can see from its specifications, the valve shown does a job that has never been done before. This type of valve problem is increasing, particularly in petroleum, chemical, rocketry, atomic energy and research applications.

AiResearch has designed and manufactured thousands of valves to meet special requirements. We are prepared to solve valve problems which include the handling of liquid nitrogen, liquid oxygen and pressurized helium . . . which require operation without fail under the most rigorous extremes of heat, cold and other environmental conditions.

If you have a problem involving specialized valves, we invite you to contact us. Our engineers will analyze your problem with you and recommend a solution.

THE GARRETT CORPORATION

AiResearch Industrial Division

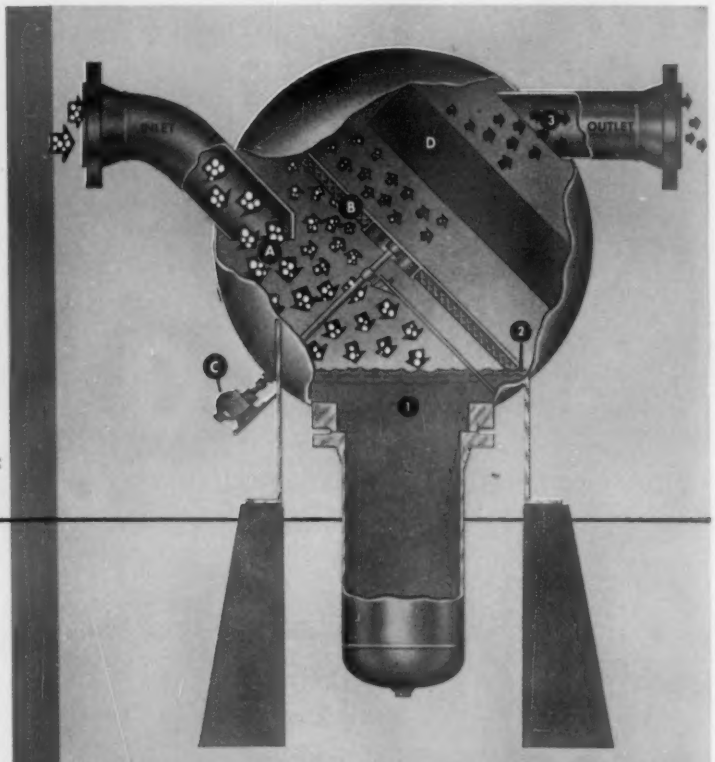
9225 South Aviation Boulevard, Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND SPECIALIZED INDUSTRIAL PRODUCTS

MORE EFFICIENT RESULTS!

PEERLESS SCRUBOSPHERE*

*Spherical scrubber for dust and liquid removal from gas flow

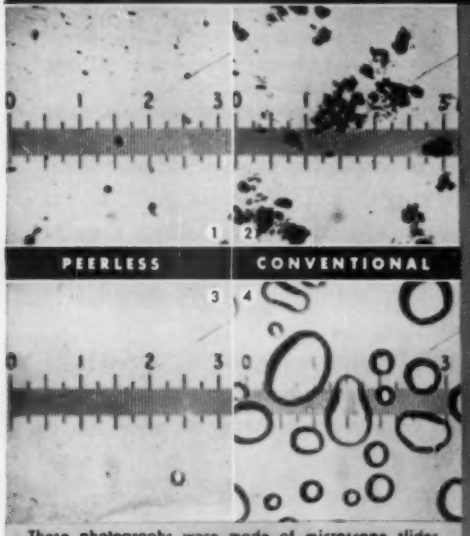


(A) The majority of incoming liquid and solid particles are directed down into reservoir. 1

(B) Lighter solid particles carried by gas stream are separated on surfaces of contactor which are kept wet and clean by revolving through liquid reservoir. 2

(C) Contactor is revolved by explosion-proof gear motor.

(D) Mist Extractor removes any remaining liquid particles from gas stream prior to outlet. 3



These photographs were made of microscope slides introduced downstream of the Scrubosphere and a conventional vertical oil bath cleaner under the same operating conditions. Plates 1 and 2 show the comparative amounts of iron oxide not removed with the amounts introduced being identical. Plates 3 and 4 indicate comparative oil loss with vapor rate through the vessels being the same.

LOOK AT THIS TEST The test at the left indicates the superiority of Peerless Scrubosphere over conventional oil bath dust scrubbers. The SCRUBOSPHERE operates with no loss of efficiency at low flows, minimum liquid loss, and very low pressure drop. Other outstanding features include easy vessel access with removable self-cleaning contactor, a sump for slugs of solid or liquid particles, and minimum cost.

For detailed information write for Bulletin No. 180

PEERLESS MANUFACTURING CO.

P.O. Box 13165 Dallas, Texas

Representatives in All Principal Cities

PEERLESS MFG. CO. DALLAS TEXAS

When it comes to oil field metering . . . there's nothing better than

ROLOCHECK

equipment

ROLOCHECK Meters measure oil by alternately filling with and discharging exactly calibrated volumes of oil. Each cycle is counted on a new, rugged counter. ROLOCHECK Meters are designed for oil field use; **proven** in oil field service . . . no gadgets, no unnecessarily complicated controls to fail in unattended operations.

ROLOCHECK METERS. For use with existing separators or treaters. Available in various capacities and working pressures. **Write for Bulletin 56R.**

Features of ROLOCHECK Meters:

(1) **Extreme accuracy.** Upper and lower liquid levels are controlled in reduced-diameter necks.

(2) **No slippage.** The new Rolo Neutral-Position 3-Way Valve is of a special design which eliminates the possibility of both inlet and outlet ports being open at once when the valve is switching ports. **Oil cannot bypass the meter.**

(3) **Minimum maintenance.** Only internals are a float and a float guide rod. Valve has sturdy rubber-to-metal inner valves. Sand and other sediments are no problem.

Also:

No minimum rate; will not pass free gas; new-design, rugged, foolproof counter. Equally efficient on oil or water measurement.

There's a ROLOCHECK Meter, in one of the forms shown on this page, for every application. Send in the coupon for complete information.

ROLOCHECK TWO-PHASE METERING SEPARATORS. Combine the ROLOCHECK Meter with an efficient separator, all in one vessel. Economical, space-saving. Write for Bulletin 56MS.

ROLOCHECK THREE-PHASE METERING SEPARATORS. Combine two ROLOCHECK Meters (one for oil and emulsion, one for free water) and a separator-free water knockout . . . all in one vessel. Write for Bulletin 56MS.

ROLO WELLCHECKERS. Completely piped separators with ROLOCHECK Meters and gas measurement facilities. Automatic free water knockouts, with ROLOCHECK Water Meters, optional. Available on skids or trailers. Write for Catalog 56W.

ROLO AUTOMATIC SAMPLER. The perfect sampling accessory to any ROLOCHECK Meter. For production containing free water, the addition of the Rolo Intermitter to the Rolo Sampler assures maximum sampling accuracy on even the highest water cuts. Write for Catalog 56W.

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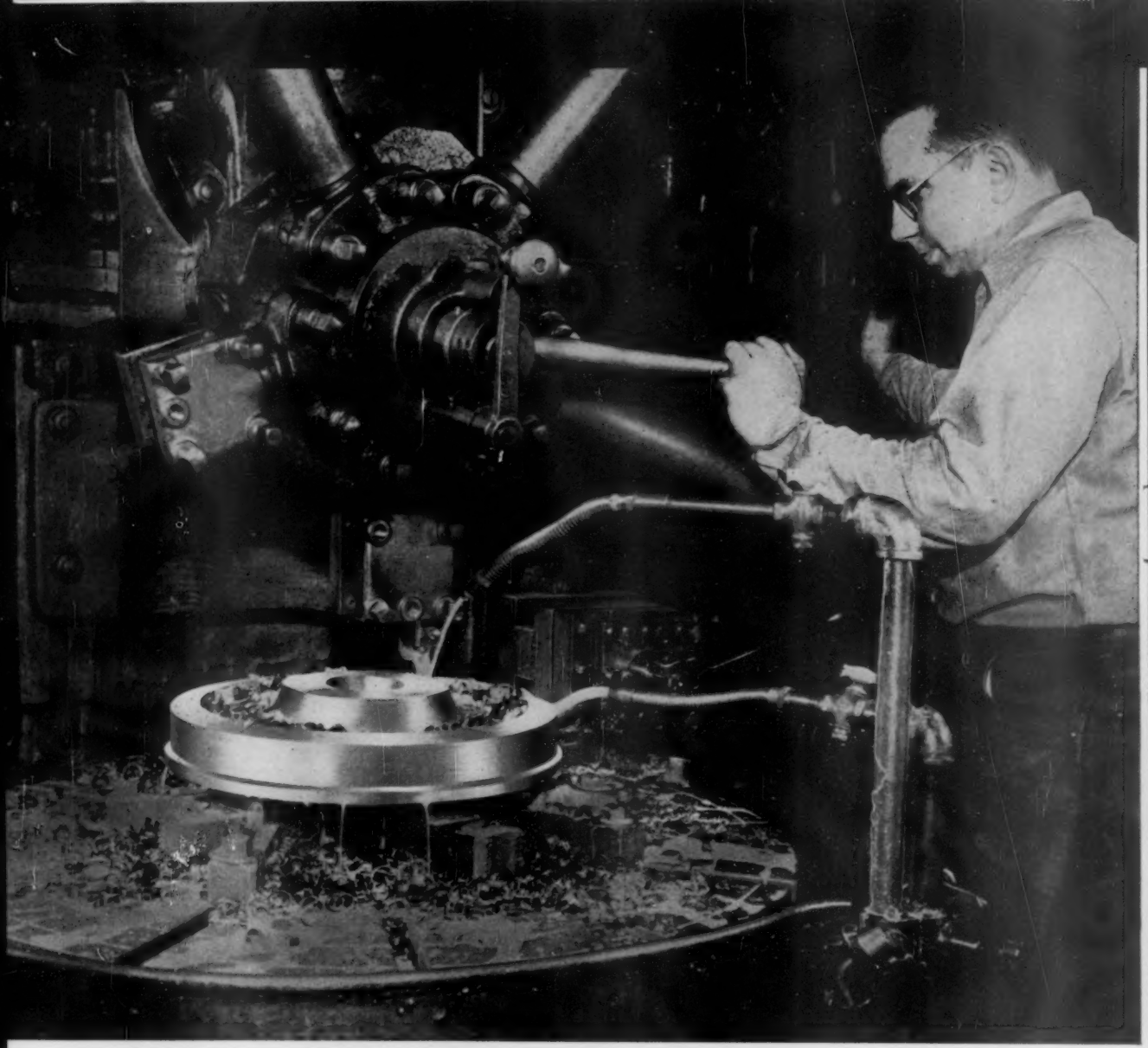

Another Good Gear on the Way

Here's a piece of work that is destined to become a transmission gear. The machinist has found it easy going because of the highly dependable blank he's using. Right from the start, he has had smooth sailing.

The blank was made by Bethlehem's forging-and-rolling process, a method of manufacture that is unique. By combining both forging and rolling in a single operation, this process imparts uniform density and smooth, regular grain flow. As a result, the metal cuts away cleanly and fast, and there is no hidden trouble to plague the machinist.

This is important. But even more important is *strength*. In Bethlehem blanks, there's strength in abundance—the strength and soundness essential for gears, crane wheels, sheaves, flywheels, and other circular products.

These sturdy steel blanks can be furnished in sizes to 46 in. OD, so there's a wide range of choice. There's also available an excellent variety of sections.

For full details, we suggest you call our nearest sales office—or write for Booklet 216, which contains more than 80 photographs and a wealth of helpful information.

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BETHLEHEM STEEL

BETHLEHEM STEEL

The Ansul dry chemical fire equipment pictured above includes portable hand units, wheeled and stationary units and a jeep installation. Ansul also manufactures automatic dry chemical piped systems, custom engineered for the hazard. Ansul equipment is listed and approved by Underwriters' and Factory Mutual Laboratories.

Only Ansul offers a Five Year Equipment Warranty

Your assurance of fast, dependable fire protection

For you, the buyer of fire equipment, Ansul's important 5 year warranty means many extra years of fast, dependable protection. It also means freedom from costly maintenance checks and repairs.

Special design and construction features make this warranty possible. Ansul's *weather-tight* construction keeps out moisture, resists corrosion. *Patented nozzles* deliver the right kind of stream for your hazard. A *sealed pressure cartridge* puts Ansul's "Plus Fifty" dry chemical to work immediately—no delay or lag. Finally, *rugged construction* makes it possible for Ansul equipment to give peak performance under the toughest operating conditions.

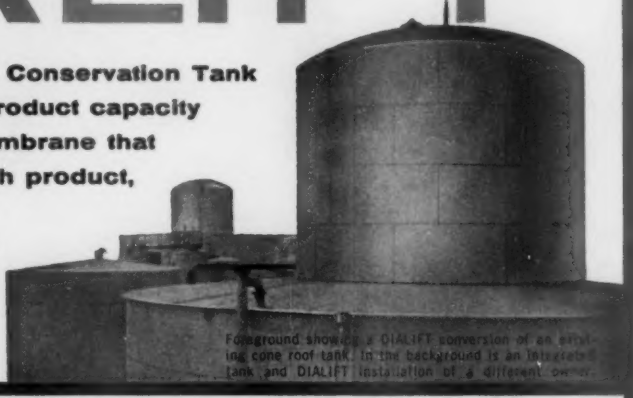
Call the Ansul Man!

Get in touch with your local Ansul man through the "yellow pages" or write ANSUL CHEMICAL COMPANY, Fire Equipment Division, Dept. F-93, Marinette, Wisconsin. *Write Ansul for your copy of new Fire Equipment Catalog.*

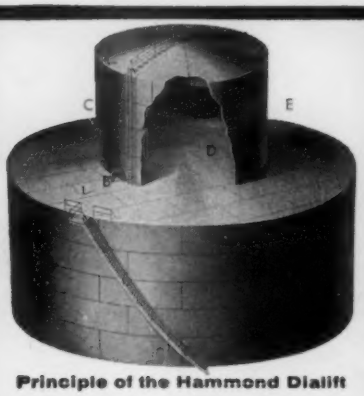
ANSUL

The HAMMOND DIALIFT

The ONLY membrane type Conservation Tank with full-rated vapor and product capacity AT ALL TIMES, with a membrane that cannot come in contact with product, vapor space that can be isolated for inspection and maintenance without taking product storage tank out of service.



Foreground shows a DIALIFT conversion of an existing cone roof tank. In the background is an integrated tank and DIALIFT installation of a different design.



Principle of the Hammond Dialift

A—**DIALIFT DIAPHRAGM rises and falls to accommodate expanding and contracting vapor.**

B—**Vapor passes to and from tank and DIALIFT through simple elbow connection.**

C—**DIALIFT and tank have full-rated capacity.**

D—**Membrane can't come in contact with product.**

E—**DIALIFT can be isolated for maintenance and inspection, product tank stays in service.**

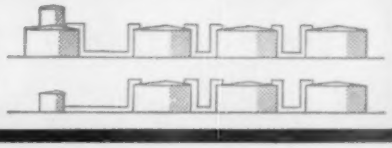
The most efficient and economical vapor conservation system for new or old tanks.

THE HAMMOND DIALIFT consists of a gas-tight Vulcalock membrane attached to the inside periphery of a cylindrical metal housing to become a "breathing" apparatus to accommodate the expanding and contracting vapor as developed in product storage tanks. The DIALIFT can be used as a single conservation unit by being attached to the roof of a product storage tank or as a central "breathing" system by being manifolded to a number of product storage tanks. There are two forms of installation: —Ground type manifolded to a number of tanks to form a conservation system and integrated type whereby the DIALIFT is attached to the roof of a product tank for vapor conservation for one or a number of tanks.

The DIALIFT is completely isolated from the product storage tank. Vapor passes between the tank and DIALIFT through a vaporline connection. It is easy to convert old cone roof tanks to efficient vapor-saving DIALIFT installations by attaching a DIALIFT housing with membrane to the roof of the old tank and connecting the vaporline between the tank and DIALIFT.

New or converted DIALIFT tank, inter-connected with cone-roof tanks, becomes central "breathing" unit.

DIALIFT GROUND UNIT serves as central "breathing" apparatus of multi-tank conservation system.



THE HAMMOND DIALIFT ELIMINATES BREATHING LOSS AND REDUCES FILLING LOSS

Other HAMMOND Bulletins describe these individual types of tanks: Floating Roof, Diaflote®, Vaporlift, Field Erected Underground, Elevated Water Tanks and Standpipes, Low Pressure, Bulk Storage.

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DU PONT Petroleum Chemicals NEWS

One of a Series of Bulletins for the Petroleum Industry

FEBRUARY 1957

Critical lubricating problems indicate growing market for estersil greases

There is a steadily growing number of industrial processes where lubricants are exposed to water and intense heat, combined with vigorous working. These applications demand lubricant performance beyond the capability of ordinary greases.

By using Du Pont Estersil GT (grease thickener), several industrial lubricant makers are meeting this demand for better greases with considerable success. Here is a typical example of how estersil can help grease suppliers meet unusually difficult lubrication requirements.

Grease life extended

A pigments manufacturer had been using a conventional grease for lubricating chemical dryer racks. This grease lost its lubricating qualities after one trip through the drying oven where the temperature averaged 120°C. This made the racks (weighing 2500 lbs.) difficult to roll manually, and resulted in excessive downtime for frequent greasing.

To increase the efficiency of this process, an estersil-based grease was tried. Success was immediate. The racks rolled easier and downtime for greasing was cut in half.

Safety increased, too

In addition to the economy realized through reduced downtime, this company got an extra dividend in increased safety. With the conventional grease, an accident occurred in which the operator's hand and wrist were jammed because the rack would not roll easily. And the danger of this—plus physical strain—occurring frequently was great. But, by making the racks roll more easily, the estersil grease eliminated this hazard.

Broad market

There are many other similar applications where greases made with Du Pont Estersil GT can best meet the critical demands of high-temperature operation, or where high water resistance is needed. They have, for example, increased efficiency in enamelling-oven conveyor setups having operating temperatures as high as 500°F.

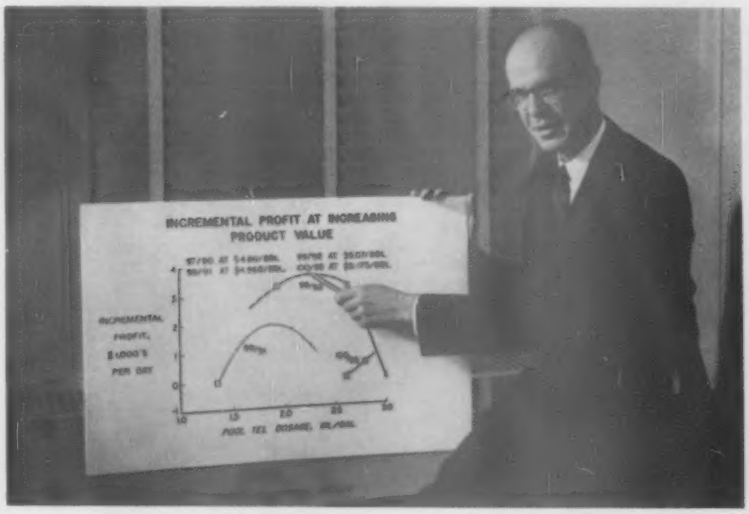
Farm tractors, mining machinery, and heavy construction equipment represent another big market for estersil-based greases. In these applications they give better protection against dirt, water and rough going . . . and help to cut maintenance costs by increasing lubrication efficiency and by reducing downtime for greasing.

Any of our sales offices will be glad to furnish more information on Du Pont Estersil GT and how it can increase grease sales and profits potential.

How economic study of operations helps increase refinery profits

by Jack S. Bellah

A modern refinery of course offers many process and gasoline blending possibilities. And selecting the combination of the variables that will produce desired product quality most economically requires a careful analysis of plant operating and laboratory blending data. Refiners who do not have their own staffs to do this work are invited to consult with Du Pont.



MANY YEARS' EXPERIENCE in refinery technology enables Mr. Bellah to make a practical, accurate economic-analysis of many refinery operations.

Those having their own economic study group may want to compare their results with ours to see if perhaps a different viewpoint can lead to further economies.

A Du Pont service

As a supplier of tetraethyl lead, we at the Du Pont Company are continuously analyzing typical refinery operations to determine their effect on the additives business. In discussing our general conclusions with people in the industry, we have been asked in several instances to make such an analysis for a specific operation. We are always glad to provide this help as a service to the refiner.

To illustrate how this service has

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DUPONT *Petroleum Chemicals* NEWS

CONTINUED *Refinery Profits*

been used, here are the results of one such investigation:

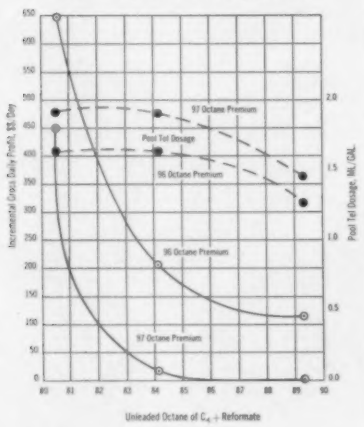
A case history

A small modern refinery recently added a catalytic reformer to the processing facilities. Three reformer operating conditions were compared—low level, design, and high level severity. A fourth case, involving jet fuel production and non-operation of the reformer, permitted calculating the break-even gross value of those gasoline components which went into the jet fuel production. Two premium gasoline octane levels also were to be considered.

The results are shown in the graph at left and in the table below.

FIGURE 1

Economic Study of Catalytic Reforming Operations



Profit up $400 per day

At the platformer design operating condition – 90% C_4 plus recovery of 84.2 clear octane product – the daily gross profit was calculated to be some $400 less than that obtained from an operation yielding 91% C_4 plus recovery of 81.1 clear octane product. This, as you can see in the table at left, was indicated at both 96 and 97 octane premium levels.

On the other hand, a disadvantage was indicated for operation at any higher severity level than the design condition. This led to the general conclusion that an even lower level of operating severity than the one estimated might be still more attractive.

Available to you

By comparing notes with you on the most economical processing steps and reforming severity, in relation to your own individual stocks and market requirements, there is a chance that we can provide a service to your own process engineering group. Just drop us a line if you would like us to discuss this service with you.

TABLE 1

Economic Study of Catalytic Reforming Operations

	Design	Lo Level	Hi Level	Down
Reformer Operation				
C_4 + Clear Research Number	84.2	81.1	89.3	Jet Fuel
Pool TEL Dosage Ml/Gal.				
96 Premium	1.625	1.65	1.275	2.685
97 Premium	1.895	1.92	1.44	2.97
Product Realization, $/CD	38880	39205	38625	30885
Variable Costs, $/CD				
96 Premium	2965	2850	2805	2965
97 Premium	3160	3045	2920	3125
Net Gross Realization, $/CD				
96 Premium	35915	36355	35820	27920
97 Premium	35720	36160	35705	27760
Incremental Gross Profit, $/CD				
96 Premium	210	650	115	
97 Premium	15	455	0	
Jet Fuel Break-Even with Best Performance Case, $/CD				
96 Premium – 11.2¢/Gal.				8435
97 Premium – 11.1¢/Gal.				8400

Residual fuel sludge problems solved with Du Pont FOA-2

At a midwestern manufacturing plant, the oil pump of an underground heavy-oil storage tank became ineffectual because of a sludge accumulation blocking the supply line. Five gallons of Fuel Oil Additive No. 2 were added to the tank, and the fuel was recirculated for several days. In this way, enough sediment was removed from the tank to permit operation of the pump.

Not only had FOA-2 dispersed the sludge—but the filters *remained* clean afterward. And the oil containing the sludge was burned in a normal manner without any harmful effect on the combustion system. Also, this simple and inexpensive method eliminated the hazardous and expensive job of lowering a man into the tank to remove the sludge mechanically.

Another FOA-2 Economy

At a New Jersey chemical plant, periodic cleaning of a heavy fuel-oil storage tank was required. In addition, large particles of solid material on the strainer before the pump caused an increase in the pump suction vacuum. On several occasions, pump suction was lost completely.

Outside service companies had previously been employed for a similar cleaning job. This time, however, it was decided to try another method. One hundred pounds of FOA-2 per 1,000 barrels were put in and the oil was recirculated.

Examination of the strainers showed no sludge-binding material. As a result, pump suction vacuum dropped to normal where it stayed. To maintain these improvements, FOA-2 is now being used regularly in a concentration of 35 pounds/1,000 barrels.

These case histories show how existing sludge problems can be easily solved and—better—prevented, through the addition of FOA-2 at the refinery.

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OVER

Serial No. A3667

Printed in U. S. A.

here's why Baash-Ross
ROLLER KELLY DRIVE BUSHINGS
are unsurpassed. . .

TWO ROLLERS instead of one for each driving surface for all Kellys.

MODERN DESIGN roller bearings with effective grease retaining seals.

ROLLER BEARINGS assure accurate, instant bit feed and sensitive drilling control.

SMOOTH, UNIFORM speed reduces maintenance cost and lengthens Kelly life.

RUGGED ENCLOSED body with one piece solid cover.

For further information write P.O. Box 1348, Houston 1, Texas or see The Composite Catalog.

The advanced, two-roller design of the Baash-Ross bushing virtually eliminates all twisting strains. The sure, sensitive feed assures steady, uninterrupted drilling—longer equipment life. A million wells have been completed at lower cost because Baash-Ross tools were on the job.

BAASH*ROSS
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Here's what you get with

KENNAMETAL* BALLS and SEATS

Exceptionally High Resistance to

- Fluid Cutting • Wear • Corrosion
- Electrolytic Action
- Ball Pounding • Ball-on-Seat Shock

If you have a problem well, or just want longer life, less pump downtime, ask your pump service man to install Kennametal API Balls and Seats. They will cost you less in the long run. KENNAMETAL INC., Dept. OG, Latrobe, Pennsylvania.

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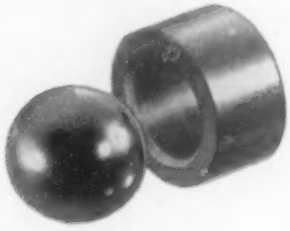

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CHOOSE THE RIGHT RIG for your jobs...

from Failing's flexible line of Portable Rigs!

Failing's MODEL 2500 HOLEMASTER®

Portable Slim Hole Rig

2500 HOLEMASTER® – deep exploration, shallow production. Choice of 10 or 18 inch tables. Double drum, air-operated hoist. Patented floating gear box. Heavy duty transmission. Dual engines coupled through hydraulic cushion drive. Finger tip air controls grouped at driller's station.

Failing's MODEL 90 STRATMASTER

Portable Slim Hole Rig

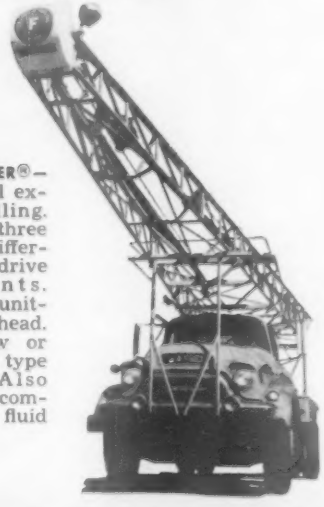
MODEL 90 STRATMASTER – designed for mobility, rapid rig-up and tear-down, with no sacrifice in strength, performance and flexibility. Trailer-mounted, Model 90 rig drills depths up to 6,500 feet. Rig is 8 ft. wide, 50 ft. long, for over-the-road portability. Exceptionally wide range of hoisting and rotating speeds. One lever control for clutch and throttles.

USED 'ROUND THE GLOBE... WITH A WORLD WIDE RECORD OF DEPENDABILITY!

GEORGE E. FAILING COMPANY

Failing's MODEL 1500 HOLEMASTER®

1500 HOLEMASTER® – all kinds of oil exploration drilling. Available in three models with different power and drive arrangements. Draw works unitized with drillhead. Choice of jaw or friction clutch type sand reel. Also available in a combination air or fluid model.



Failing's MODEL CFD-1 COMBINATION RIG

Drills With Air or Water

CFD-1 COMBINATION – fast shot hole drilling using either air or water. Hydraulically driven chain feed, controlled by a single lever. Individual friction clutches on the draw works. Widely used for uranium exploration, mining and construction blast holes. Allows recovery of wet or dry samples or cores. Available without the air compressor as CFD-1 HOLEMASTER®

Strategically located stores in the United States and Canada.

GEORGE E. Failing COMPANY

A SUBSIDIARY OF WESTINGHOUSE AIR BRAKE COMPANY

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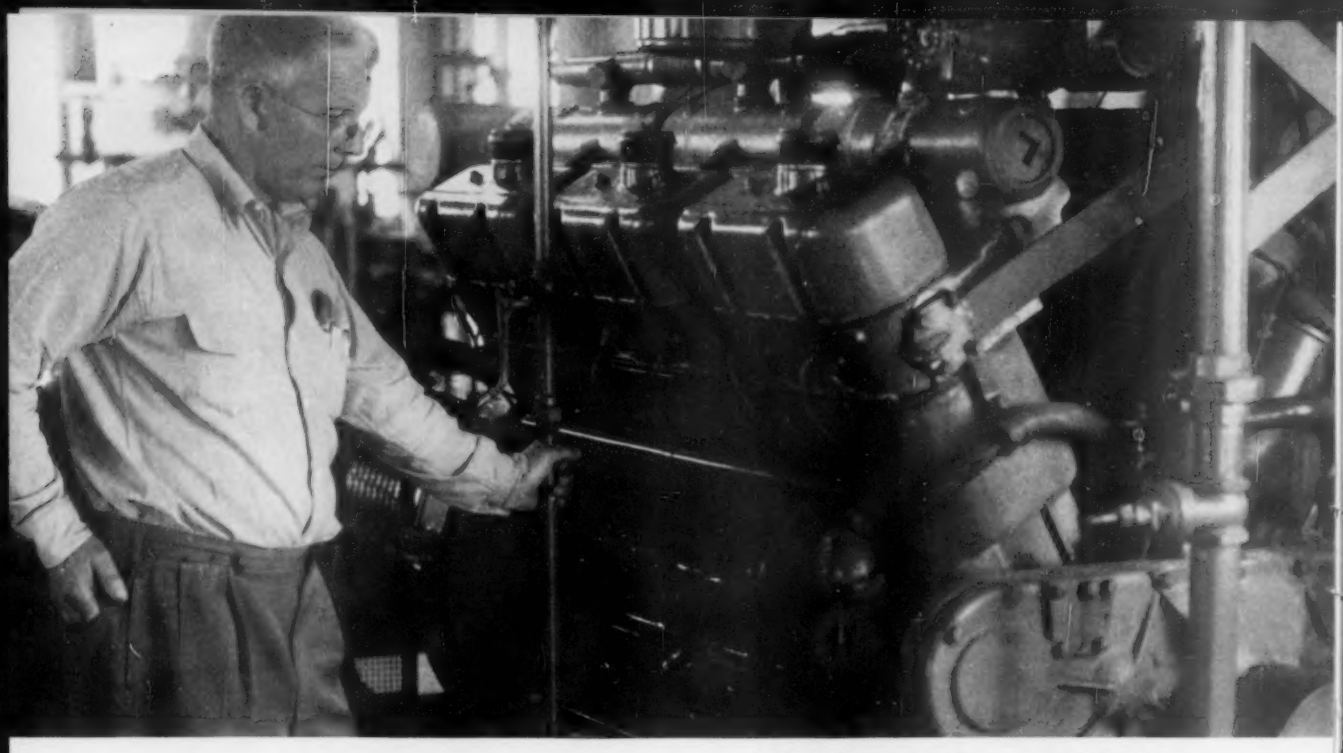
Failing service, parts and supplies are available world wide.



Le Roi engines are compact — easy to install and easy to move.

Le Roi Engine Gives 80,000 Hours Service without an Overhaul

Pumps 635 barrels of crude an hour at 230 pounds pressure.

Operating cost for fuel, lube oil, and maintenance is less than 1¢ per barrel.

Near Notrees, Texas, there's a pipeline station that's awfully proud of its Le Roi L3000 engine. It has worked over 80,000 hours without an overhaul.

It's the workhorse of the station. According to the superintendent, this Le Roi really puts out — does twice as much work as other engines in the station having the same horsepower rating.

This ability to work hard for long periods is characteristic of all Le Roi engines, whether they are used for pipeline service or for powering drilling rigs. Le Roi's V-type, overhead-valve design puts a lot of power into a small space: you get more horsepower per dollar.

Performance no "flash in the pan." The engine shown here has been running for more than 9 years. It has given 80,000 hours of service without an overhaul. This is noteworthy performance in itself. Yet, during this time, only $500 has been spent for repairs.

Through acidity tests every thirty days, coupled with regular oil filter change, considerably longer life of the lubricating oil is accomplished.

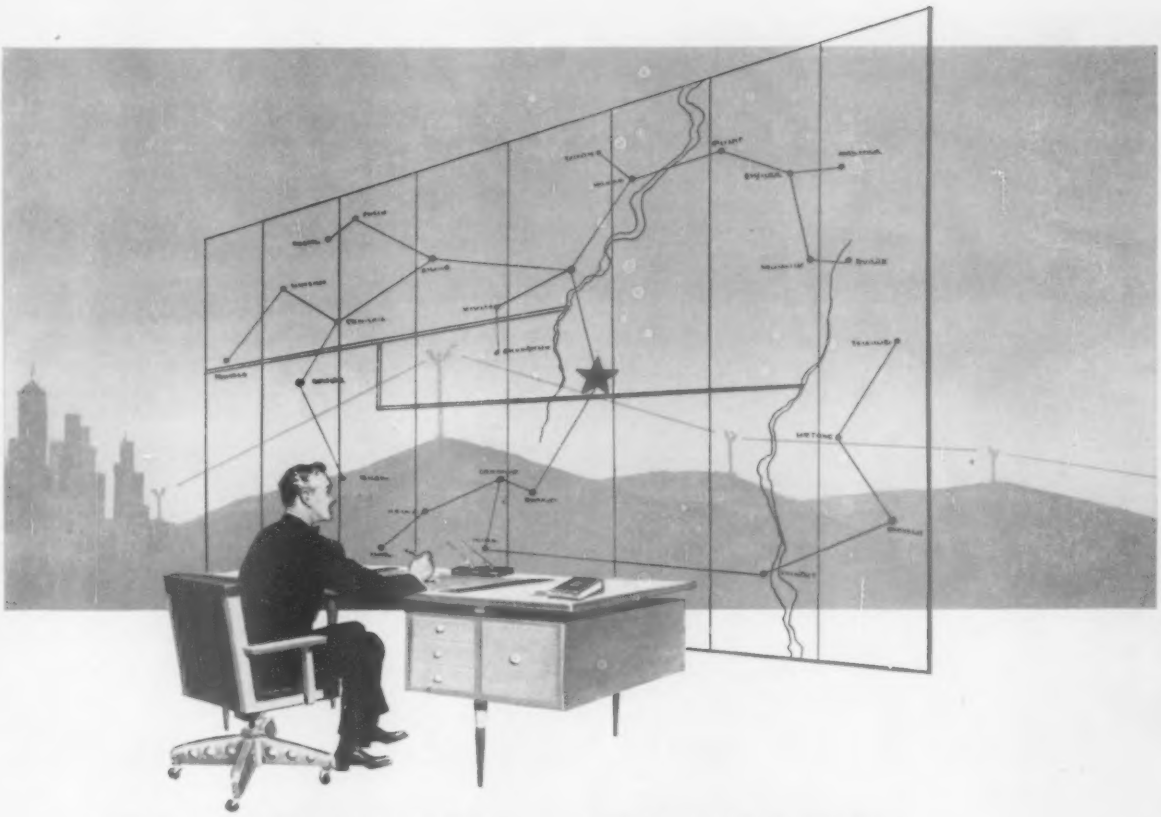
Compact size is important feature too. Pipeline stations as well as drilling rigs have a moving problem. Compact design, featured in all Le Roi engines, allows them to be moved quickly and easily to other locations after a field goes down.

Whatever your needs for oilfield power, it will pay you to investigate the design advantages of Le Roi engines. Have your nearest Le Roi distributor show you Le Roi's at work. Ask the user what he thinks about them. Sizes range up to 635 hp and literature is available. Just write us for prompt action.

L3000 runs at 1050 rpm and drives this pump with 7-inch liners at 72 strokes per minute.

LE ROI Division of Westinghouse Air Brake Co., Milwaukee 1, Wisconsin, manufacturers of Cleveland air tools, Tractair, portable and stationary air compressors, and heavy-duty industrial engines. Write us for information on any of these products.

P-148



TEN MILES OR A THOUSAND . . .

Motorola Microwave puts complete operational control at your fingertips

Cross-country or cross-town—Motorola Microwave can give you centralized control in one *complete*, privately-owned communication system that spans city streets, rivers, and mountains with ease. Multiply your present communication facilities with this work-horse that provides multi-channel facilities for transmitting and receiving orders and instructions by voice, printed messages and control signals. It will speed a thousand tasks a day, working 'round the clock to give you better control, improved coordination and increased efficiency . . . all at a substantial savings in cost.

With Motorola Microwave serving all types of applications (many of them in your industry) you get the benefit of extensive experience. In installation after installation, operational records prove that Motorola Microwave performs better, lasts longer and costs less to maintain.

Learn how Motorola Microwave can give you the *complete* communication system for centralized control. Write, wire, or phone today.

VOICE

Private line and party line—manual and dial telephone circuits—VHF mobile and base station 2-way radio . . . *all* can be carried hundreds of miles, economically and privately, by Motorola Microwave.

PRINTED MESSAGES

Read a message, a chart or facsimile a thousand miles away in seconds. Assemble necessary information the fast, efficient way. Teleprinting, telemetering, telegraph, facsimile are at your command with Microwave.

CONTROL SIGNALS

Read meters, turn valves, from *any* central location you want. With Motorola Microwave you can have supervisory control, remote control, and remote indication. Greater efficiency at less cost.

MOTOROLA MICROWAVE

Motorola Communications & Electronics, Inc., 1400 N. Cicero Ave., Chicago 51, Ill., A subsidiary of Motorola, Inc.

"After 150,000 feet, these U. S. Rainbow V-Belts were good as new!"

says "Red" Royal

"At Oil Production Maintenance Company's rig N-75," says "Red", "toolpusher Lefty Wood swears by U. S. Rainbow® V-Belts. The belts (U.S. Rainbow D540) worked steadily on a Wilson-Snyder pump for 2 years, and just wouldn't wear out or go haywire."

"Red" doesn't want any other kind of belts. That makes sense, because these U.S. Rainbow V-belts had already drilled 150,000 feet at a belt cost of less than a cent a foot.

"Red" can name many a cost-conscious driller who insists on U.S. Rainbow to help him drill *more* hole in the *same* number of days. In every oil field U.S. Rainbow V-Belts are hard at work, taking rough shock treatment on location after location, never letting anyone down.

This same rig also uses another record-breaking "U.S." product—U.S. Royal 4 Rotary Hose, as well as U.S. Suction Hose and U.S. Vibrator Hose. Rely on "U.S." to give you *quality* and help you in the battle against downtime.

Developed by Science . . . Proved by Drillers

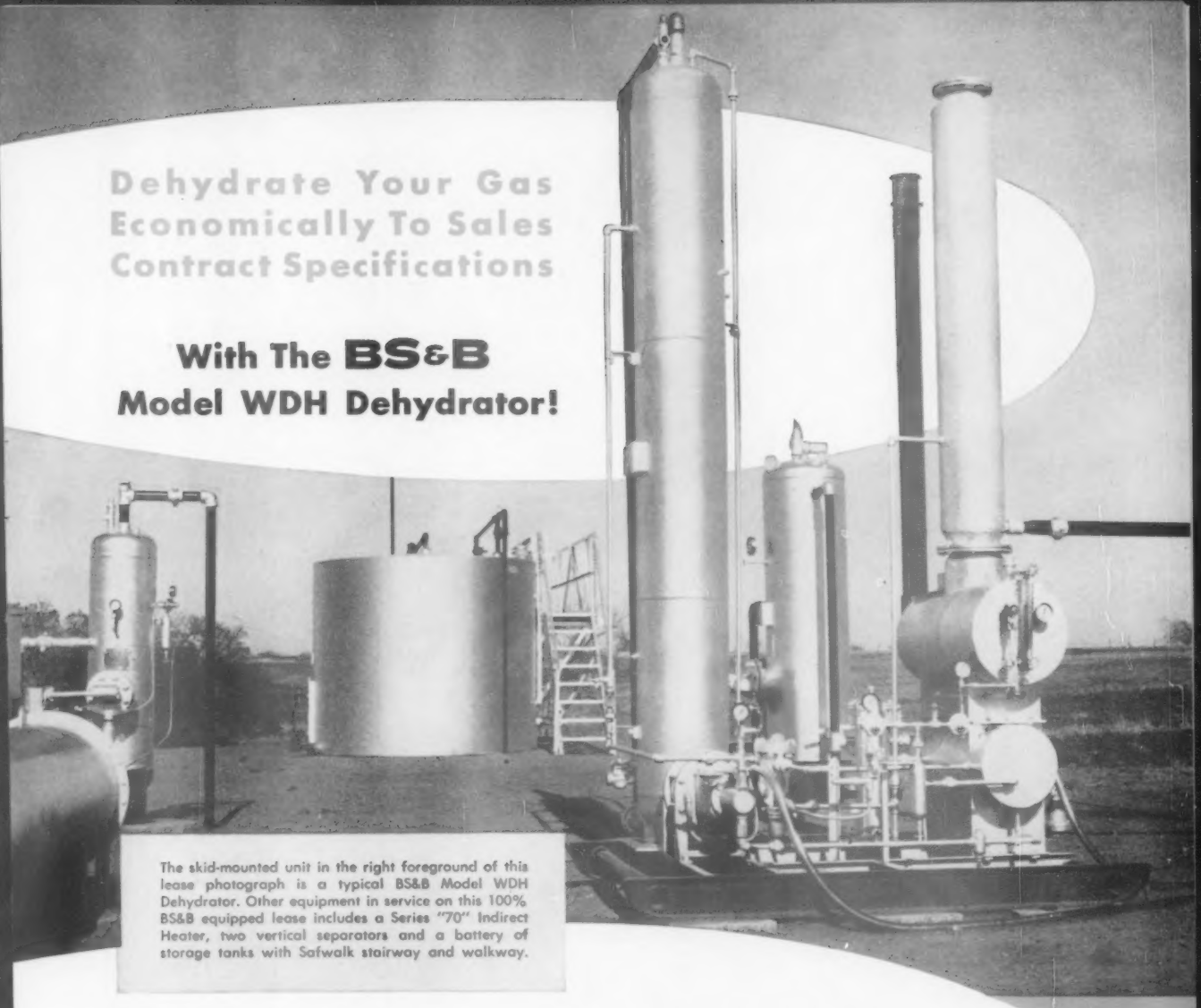
US RUBBER

Mechanical Goods Division

United States Rubber

Dehydrate Your Gas Economically To Sales Contract Specifications

With The BS&B Model WDH Dehydrator!



The skid-mounted unit in the right foreground of this lease photograph is a typical BS&B Model WDH Dehydrator. Other equipment in service on this 100% BS&B equipped lease includes a Series "70" Indirect Heater, two vertical separators and a battery of storage tanks with Safwalk stairway and walkway.

Costs Less To Buy . . . Costs Less To Operate!

The BS&B Model WDH Dehydrator is the *original* lease size glycol type gas dehydrator designed to produce a 65°F. minimum water dewpoint depression at low operating cost. Units designed to produce water dewpoint depressions of 75°F. minimum or 90°F. minimum can be furnished for special problems.

Under normal operating conditions, glycol consumption of these units will not exceed one-tenth gallon per 1 MMSCF of gas processed. Initial investment in the unit itself is only about one-half that required for most other types of automatic gas dehydrators.

Standard units are available in nominal gas capacities ranging from 1 to 60 MMSCFD, but special sizes have been built with gas capacities of up to 500 MMSCFD. All units are skid-mounted (to the extent that shipping limitations will allow) and can be quickly and easily hooked up in the field.

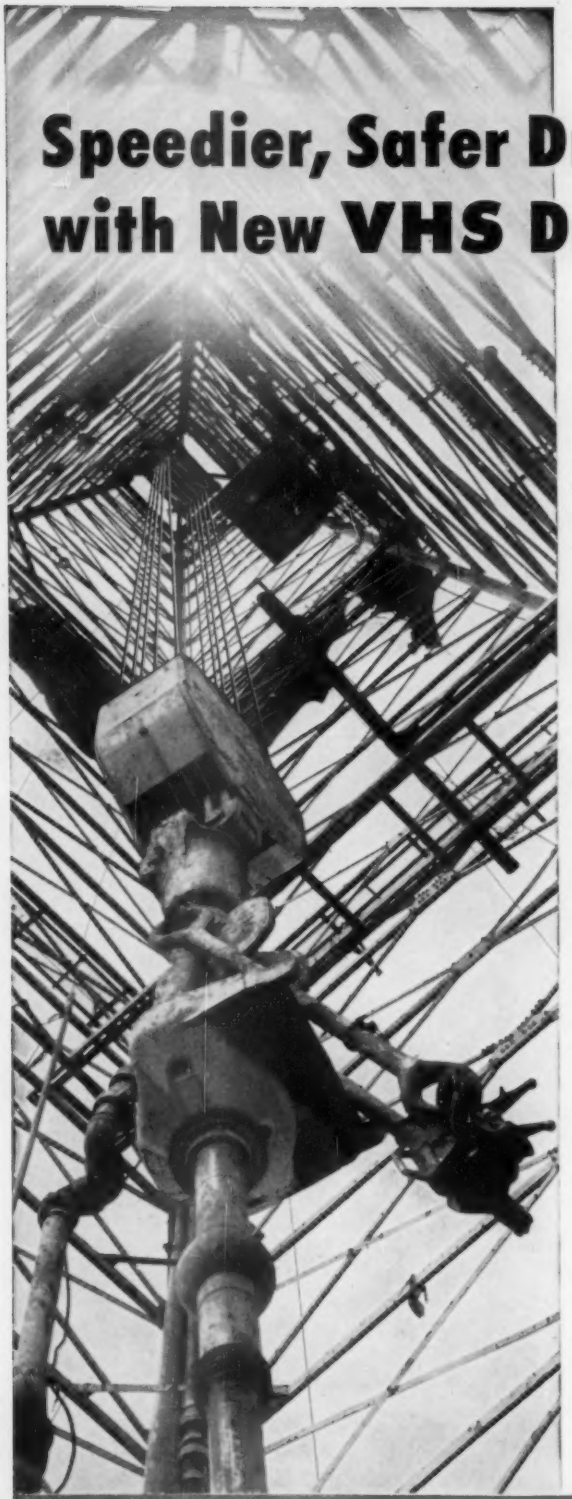
For extremely cold climates, BS&B offers a complete line of Model WDH Dehydrators especially designed for cold weather operation without expensive housing. Ask your BS&B Man for details—or write to . . .

EFFICIENCY OVER 60 YEARS BS&B RELIABILITY
ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

BLACK, SIVALLS & BRYSON, INC.

Oil & Gas Equipment Division, Dept. 1-A2

P. O. Box 1714 Oklahoma City, Oklahoma



Speedier, Safer Drilling— with New VHS Drilling Lines

• More and more operators are getting faster, safer drilling with rotary drilling lines of new LAY-SET VHS. For new VHS is at least 15% stronger than Improved Plow Steel—the strongest grade available before VHS.

DRILL DEEPER

This extra strength means you can drill deeper before increasing the number of parts of line. You can make round trips faster. And VHS's extra strength eliminates in many cases any necessity for buying new blocks or regrooving sheaves to use larger diameter lines for higher safety factor.

HIGHER SAFETY FACTOR

The safety factor for 10 lines of new LAY-SET VHS is equal to that for 12 lines of IPS. Or, with 10 lines of VHS the safety factor is about 14.9, or 15%, higher than with 10 lines of IPS.

TOUGHER, TOO

A new VHS is tougher. It has greater resistance to abrasion and higher resistance to peening—both important factors in maintaining shape and diameter. Following regular, adaptable cut-off practices should result in ton-mile advantages.

WINCH LINES, TOO

Now new LAY-SET VHS is available in winch lines—where its extra strength and toughness pay big dividends.

Call your Hazard distributor for rotary drilling lines or winch lines of new LAY-SET VHS. Just tell him the size and diameter you want—no complicated specifications are necessary.

for further information write to the nearest Hazard office for Brochure **DH-522**

LAY-SET VHS

15% Stronger • Tougher •

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American Chain & Cable Company, Inc.

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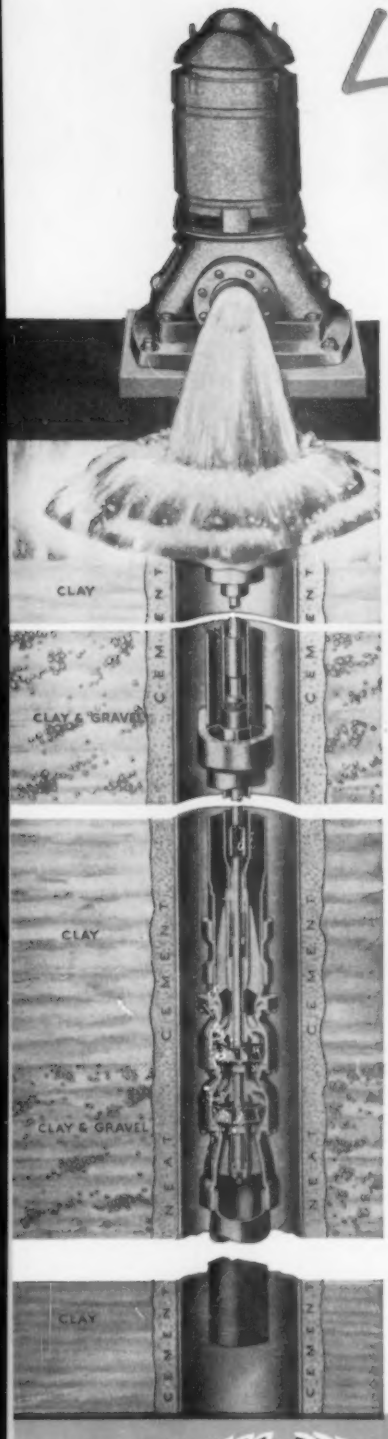
86 YEARS OF PROGRESS WITH THE OIL INDUSTRY

Layne knows more about water bearing formations!



On whose say-so? Not on ours—but on the experience of scores of American and foreign firms and municipalities whose very existence and success depend on an adequate supply of water.

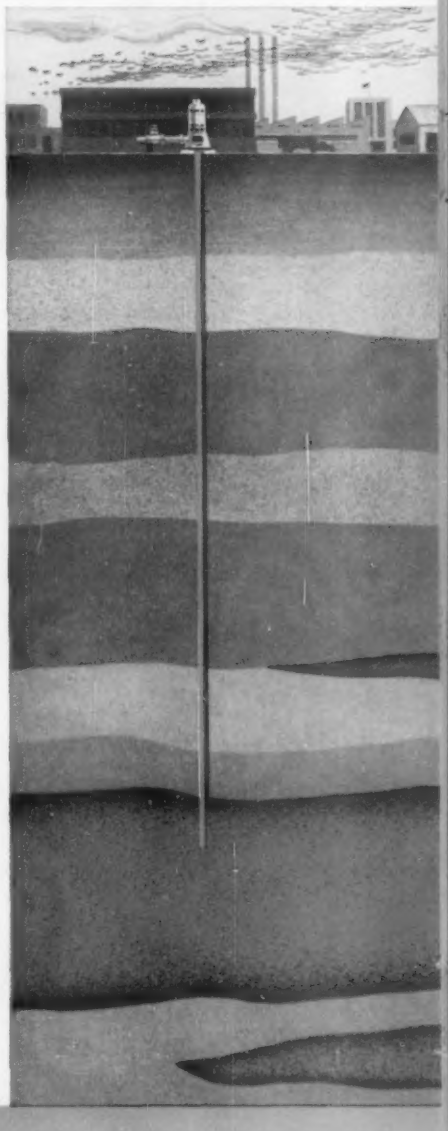
Knowing where the water is — and then tapping the subterranean source is but a part of the vast knowledge the Layne organizations have accumulated in three quarters of a century.

Once the source is determined and the water supply developed, a dependable means for delivering the water must be provided, and that's where the famous Layne pump comes in. For each Layne pump is specifically engineered for the particular job. There is no "stock" Layne pump. Your pump is created for your job —making use of the knowledge of strata, water requirements and usage.

ENGINEERED, DEPENDABLE PERFORMANCE IS WHAT YOU GET WHEN LAYNE DOES THE JOB — COMPLETE FROM WATER LOCATION TO YEAR AFTER YEAR OF TROUBLE-FREE PUMPING.

YOUR NEXT WELL AND PUMP INSTALLATION MAY BE MONTHS OFF. GET TO KNOW THE LAYNE FOLKS IN YOUR AREA. SAVE TIME AND MONEY THROUGH THEIR INTIMATE KNOWLEDGE OF WATER.

Send now for our general services bulletin No. 100.



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75 YEARS OF PROGRESS

WATER WELLS • VERTICAL TURBINE PUMPS • WATER TREATMENT

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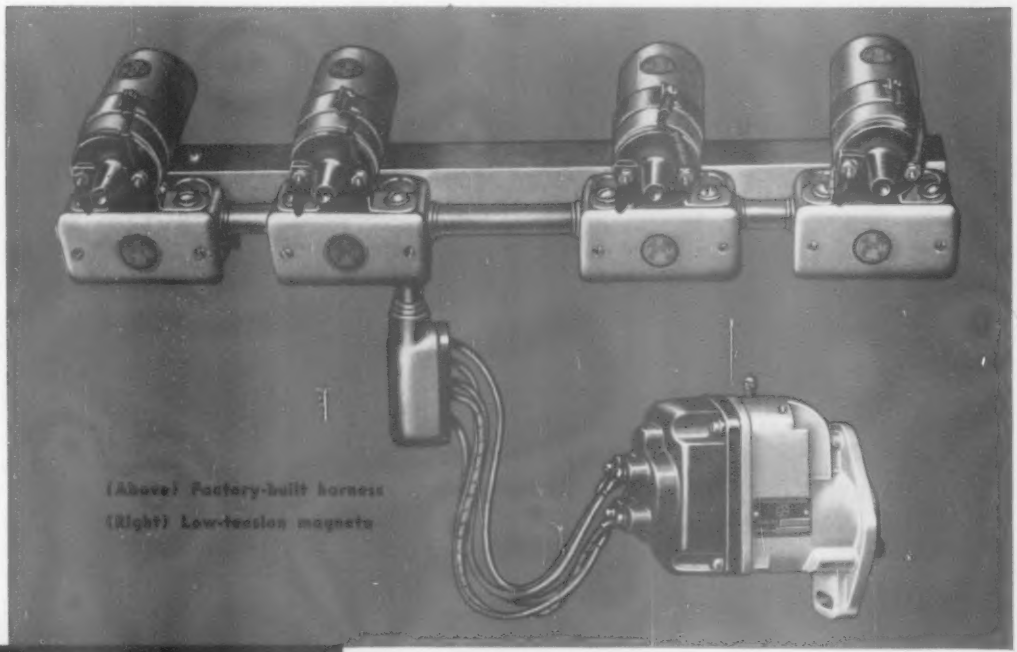
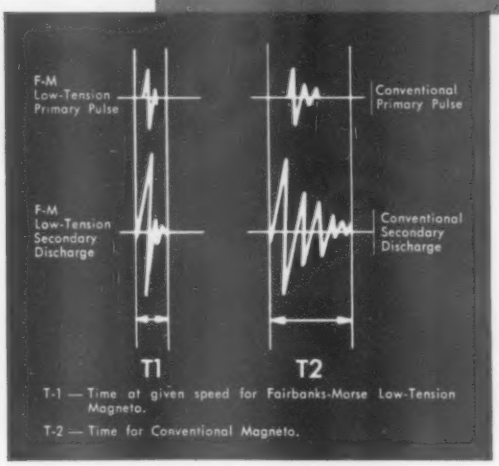
General Offices and Factory • Memphis 8, Tennessee

LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD

Stop engine breakdowns, reduce costs!

Improve firing, extend spark plug life... by installing new low tension ignition!



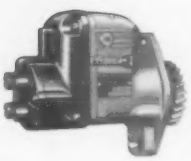

F-M Low-Tension Primary Pulse
Conventional Primary Pulse
F-M Low-Tension Secondary Discharge
Conventional Secondary Discharge
T1
T2
T-1 — Time at given speed for Fairbanks-Morse Low-Tension Magneto.
T-2 — Time for Conventional Magneto.

New model engines with their higher compression ratios, as well as thousands of engines already in the field, all show vastly improved performance with the Fairbanks-Morse low-tension ignition system. The short duration, high peak voltage spark liberates more than enough energy (heat) to ignite a full charge under all engine operating conditions.

Bearings and other magneto parts last longer because there is no problem with ozone or high corona discharges within the magneto case. In addition, a major improvement in spark plug life results from reduced electrode erosion due to the shortened voltage-time characteristic.

Fairbanks-Morse low-tension magnetos are no larger than standard units, thus simplifying installation. Complete factory-built harnesses that include transformers, junction boxes, mounting hardware, lead wires, etc. are available for nearly all popular engines up to 4000 cu in. in displacement.

MORE THAN 4,000,000 MAGNETOS IN USE



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A name worth remembering when you want the BEST

MAGNETOS • REWIND STARTERS • WATER SYSTEMS • GENERATING SETS
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Fairbanks, Morse & Co., Magneto Division
Beloit, Wisconsin

Please send Bulletin FM238A describing the Fairbanks-Morse low-tension ignition system.

Name_____

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You, personally, are "right next door" to an alert source of supply of Fisher control valves, gas regulators, liquid level controllers and pressure regulators.

Whether your problem is one of existing equipment—or an entirely new control application—the Fisher country-wide network of 3 factories, 22 strategically located field stocks and 53 representatives, with 203 Fisher Service Engineers—offers you convenient service on all your control requirements.

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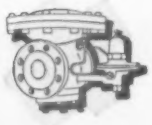

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PUMP GOVERNORS

LEVER AND FLOAT VALVES

a Name SYNONYMOUS with *Quality*

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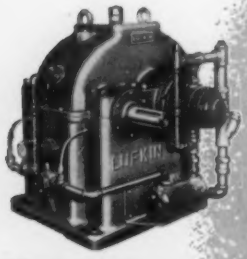
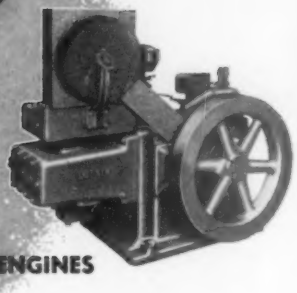
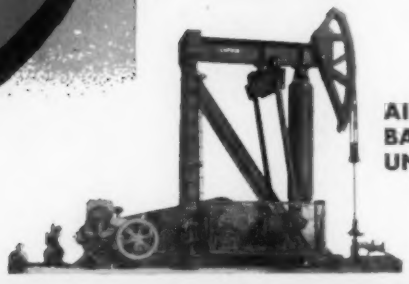


SPEED REDUCERS AND INCREASERS



GAS ENGINES



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Quick as a cat... Quiet as a mouse

CHAPMAN
Tilting Disc Check Valve

There, in a nutshell, is the story of a Chapman Tilting Disc Check Valve . . . quick as a cat, quiet as a mouse. It's designed that way. It's built that way . . . for fast, sure, quiet action. Or, in other words, it's yours for best performance at lowest long-range operating costs.

With a Chapman Tilting Disc Check Valve, there's no noise, no vibration, no fluttering. There's no banging or slamming with damage to system or valve. There's no scraping or wearing of disc and seat. Your head loss or flow resistance is kept at a minimum.

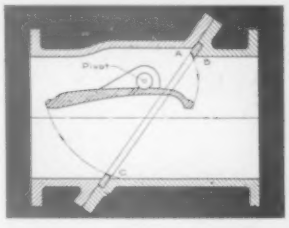
To put it briefly, with a Chapman Tilting Disc Check Valve, there's little or no maintenance even under severe operating conditions.

For Chapman Tilting Disc Check Valves in iron and steel . . . valves for handling fluids or gases under a wide range of pressures . . . valves for replacement or new piping systems . . . just check our Catalog 30-A. It's yours for the asking. Send for it now.

The CHAPMAN Valve Mfg. Company
INDIAN ORCHARD, MASSACHUSETTS

Never a Flutter, Never a Slam!

Designed and Built for Quiet Efficient Operation



In open position, specially designed "airfoil" disc balances perfectly. No vibration. No flutter. When flow subsides, disc drops quickly and quietly to a tight closed position. No jarring. No slamming. No damage to system or valve. Note enlarged area around disc to insure low flow resistance.

A new look in pipe lines . . .

"THE WORLD'S

FIRST" *installation of*

NATIONAL EXPANDED SEAMLESS LINE PIPE

a 252-mile line from Hebron, Pa., to Greenwich, Conn.

Expanded Seamless Line Pipe is a new product of National Tube—never before used in a pipeline installation. The 252-mile, 24-inch line was installed by Tennessee Gas Transmission Company, from their Hebron underground storage field near Coudersport, Pennsylvania, to Greenwich, Connecticut.

The pipe was apportioned in the following sizes:

205 miles of 24-inch, ⅜-inch wall
46 miles of 24-inch, ½-inch wall
1.5 miles of 24-inch, ⅝-inch wall

* * *

Not only is National *Expanded Seamless* easier to weld at all temperatures, but it possesses greater, more uniform strength than ordinary line pipe. This high strength permits safer operation at high pressures under all conditions. And the uniform internal size of *Expanded Seamless* facilitates field line-up and welding. It is available in sizes 16-in. to 26-in. O.D., in a full range of wall thicknesses.

On all counts, National *Expanded Seamless* Pipe is absolutely unparalleled for line installations. For improved efficiency and greater economy on *your* next line pipe job, plan to install National *Expanded Seamless* Line Pipe.

IN PIPE LINES TOO . . . SEAMLESS DOES IT BETTER

The pipe laid in the populated areas was yard-coated with coal-tar enamel, glass mat, and asbestos felt. Bending was accomplished by a bending machine at the yard.

Possessing superior welding characteristics, National *Expanded Seamless* in ½-inch wall was welded with five to six beads; in ⅜-inch wall with four beads. The pipe was delivered with a 30° bevel.

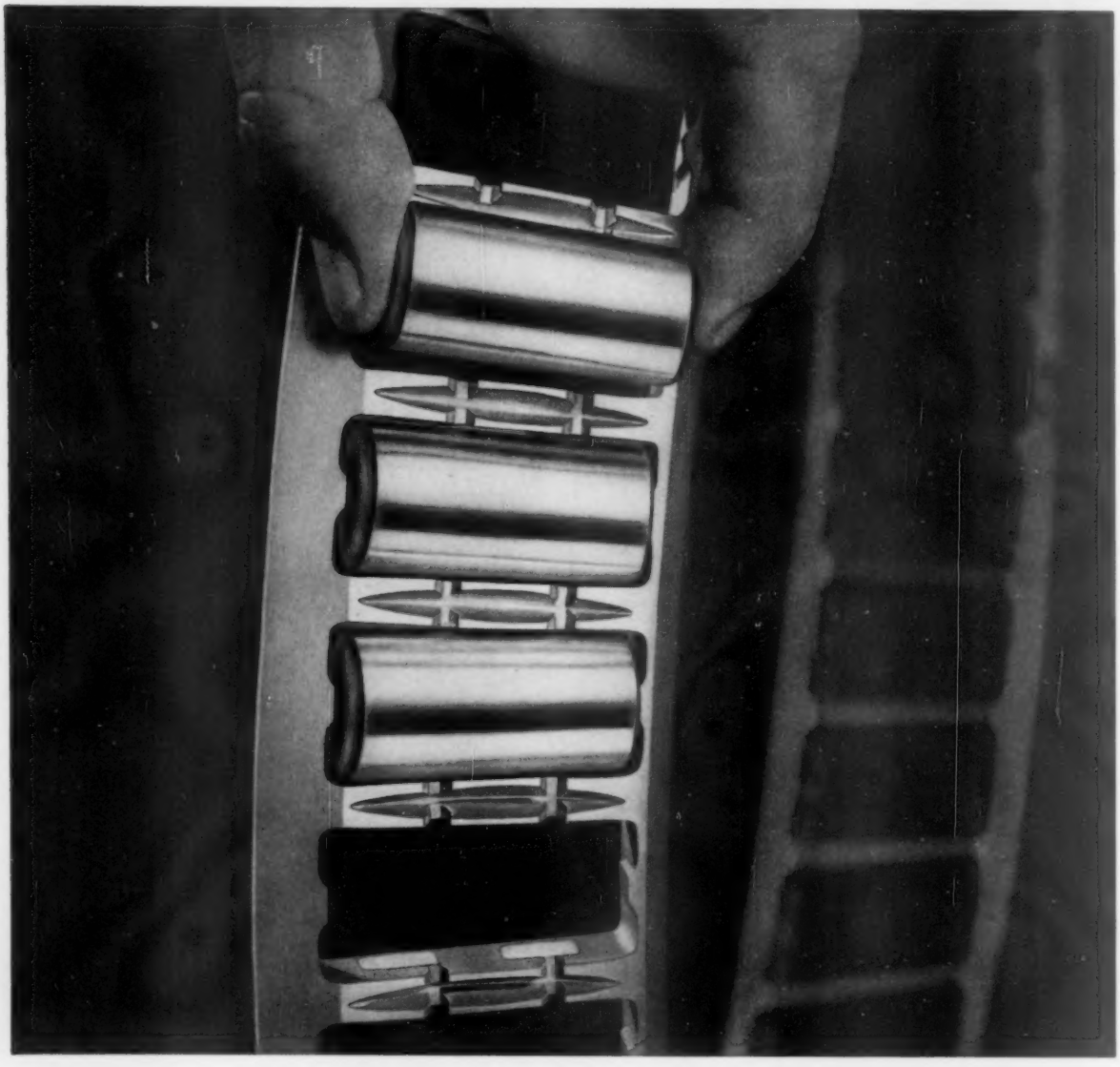
NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

NATIONAL SEAMLESS PIPE AND TUBES

WALLS WITHOUT WELDS

UNITED STATES STEEL

TORRINGTON *TAPERED ROLLER* BEARINGS



Accurately caged... to cut your costs!

The one-piece, cast-bronze cage you see above is one of the reasons why TORRINGTON Roller Bearings give long, low-cost service. Note the individual roller retainment, for example. This helps keep the rollers thoroughly lubricated at all times. Race surface inspection is simplified. The machined pads in each roller pocket make sure the rollers are guided accurately at the pitch line. All this to minimize wear... lengthen bearing life.

Yes, TORRINGTON Roller Bearings cut your costs. They're made of the finest bearing quality steel available, heat treated by the most modern methods. No wonder they're so rugged... so dependable. Specify TORRINGTON *Tapered* or *Cylindrical* Roller Bearings for heavy loads and low maintenance.

THE TORRINGTON COMPANY
South Bend 21, Ind. • Torrington, Conn.
District offices and distributors in principal cities of United States and Canada

TORRINGTON BEARINGS
Spherical Roller • Tapered Roller • Cylindrical Roller
Needle • Ball • Needle Rollers

New RIDGID 4PJ Geared Threader Is Now

*JAM-PROOF

*Automatically Stops Threading When Standard Length Thread Is Cut

Power drive threading is safe and easy with this new 4PJ—no more watching of either die stock or drive! 4PJ can't jam—drive pinion kicks out automatically when full thread is cut. Extra-easy to handle ...mistake-proof workholder, no bushings...fully enclosed gears... RIDGID most-for-your-money—Buy new 4PJ at your Supply House!

← RIDGID 400A Power Drive with Universal Drive Shaft operates 4PJ Threader on 4" pipe held in Tristand Chain Vise, all RIDGID products.

RIDGID
Work-Saver Pipe Tools

The Ridge Tool Company, Elyria, Ohio, U.S.A.

P.E.S.A.–a billion-dollars-a-year helper to the drilling and producing industry

Over half a billion service miles are traveled each year by PESA members to serve their great customer, the oil industry.

Over nine thousand research scientists, development engineers, design engineers, metallurgists, field engineers design, improve, and perfect equipment and services in order to more efficiently find oil formations and drill and produce wells.

More than 1.5 billion dollars was spent on oil field machinery and services and tubular goods in 1955, according to a Commerce Department report. By far the greater part of this expenditure was to PESA members.

P.E.S.A. is

...an association composed of

95 MANUFACTURERS that can make *ALL* the equipment necessary for carrying on all field operations. They are constantly investing immense sums of money in research, development engineering, design engineering, metallurgy, and field engineering in order to regularly bring out new products and improve their standard products.

35 SUPPLY COMPANIES that can supply *ALL* the equipment necessary for carrying on oil field operations. The field store is a place where drilling and production personnel can select from new and improved equipment that will help them do a better job, a place to keep current with the news, to get and exchange technical information, and to do business.

25 SERVICE COMPANIES that give *ALL* the special services required for carrying on oil field operations . . . and in addition offer the services of their technically trained and experienced specialists to help analyze well problems and recommend effective, economical solutions. They carry on research in a constant search for better, more efficient, more economical ways to perform their various services.

No matter what the future requirements of the oil industry, PESA members *will always be ready.*

P.E.S.A.*

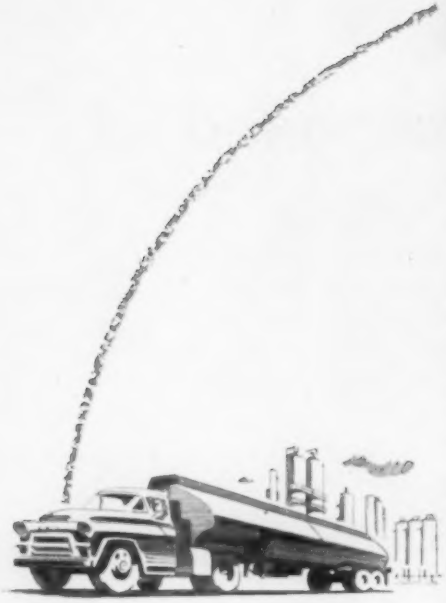
PESA members have invested billions of dollars in plants and equipment under the incentive of the free enterprise system in order to supply the oil industry with precision equipment and services in such quantities that the customer gets them *when* and *where* wanted.

* PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

6511

ADD MILES

to the life of your trucks!



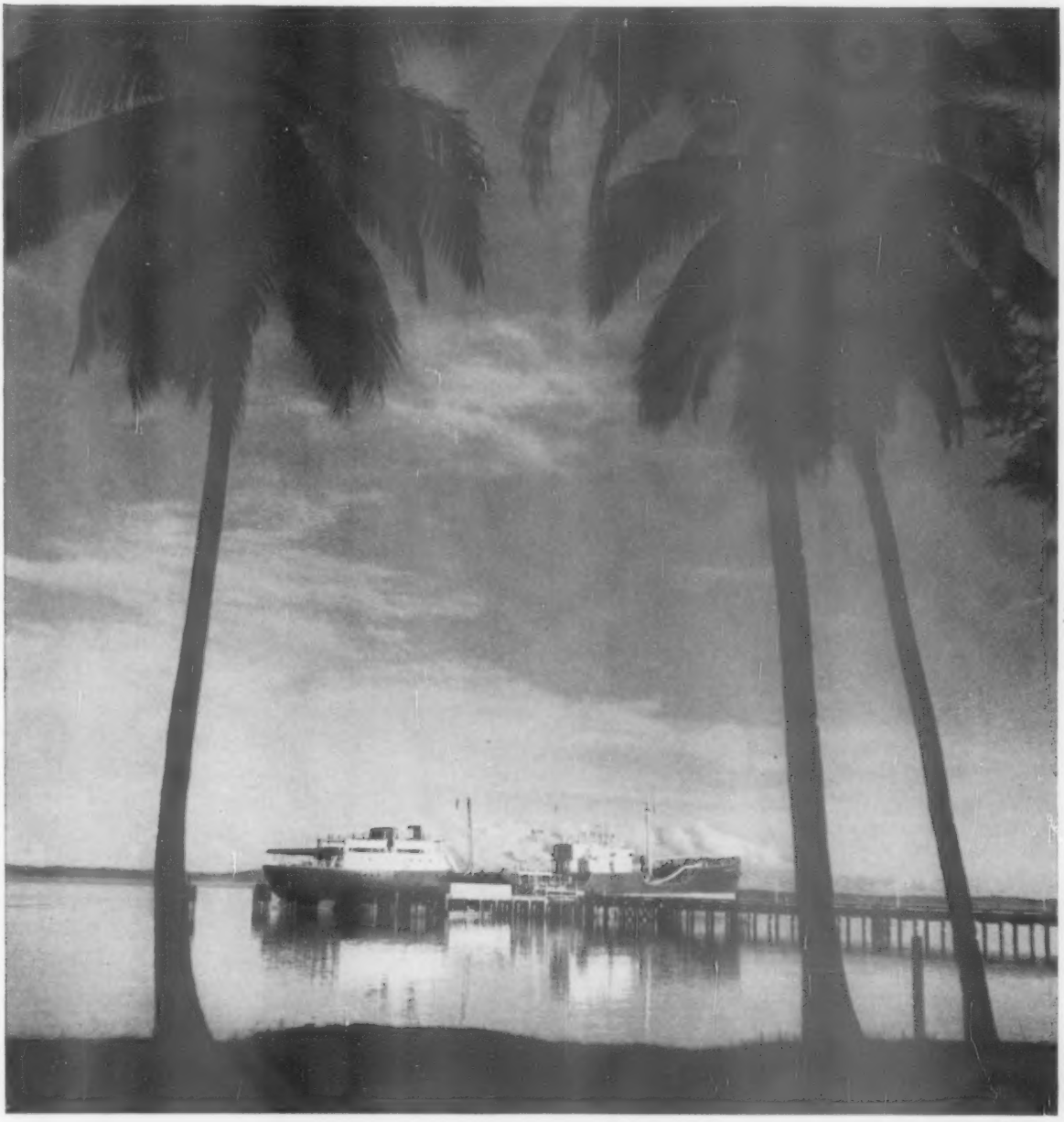
By furnishing the right gear ratio for every operating condition, Eaton 2-Speed Axles permit engines to run in their most efficient and economical speed range. The result is reduced stress and wear—longer life for engines and all power transmitting parts. Thousands of trouble-free, low-cost miles are added to vehicle life. In addition, operating and maintenance costs are held down. Trucks stay on the job, out of the repair shop—and are worth more on the trade-in. Ask your truck dealer to explain how Eaton 2-Speeds pay for themselves over and over.

EATON
2-SPEED
AXLES

More than Two Million
Eaton Axles in Trucks Today.

EATON AXLE DIVISION
MANUFACTURING COMPANY
CLEVELAND, OHIO

PRODUCTS: Engine Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Hydraulic Pumps Motor Truck Axles • Permanent Mold Gray Iron Castings • Forgings • Heater-Defroster Units • Automotive Air Conditioning Fastening Devices • Cold Drawn Steel • Stampings • Gears • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers



"Change is a law of life. But what is disturbing is evidence now and then of a drift backward to the old notion that agreements are merely scraps of paper. The world cannot be organized for its own good on any such foundation of irresponsibility. We must be able to rely upon each other's word. There is no other principle on which people and nations can work together for progress and their mutual benefits."

– Eugene Holman, Chairman of the Board, Standard Oil Company (New Jersey)

Esso 75 YEARS

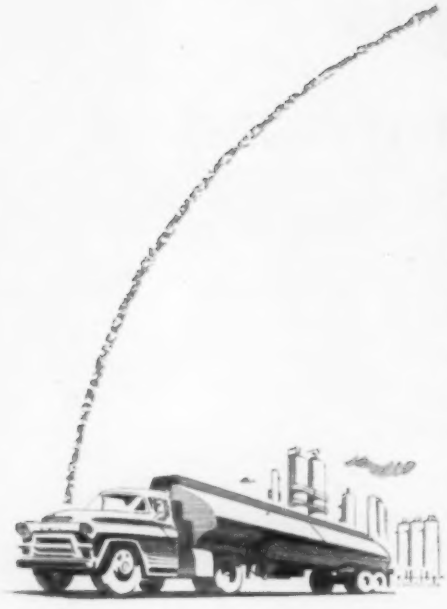
producing energy for an abundant life

STANDARD OIL COMPANY (NEW JERSEY)
AND AFFILIATED COMPANIES

ADD MILES

to the life of your trucks!

By furnishing the right gear ratio for every operating condition, Eaton 2-Speed Axles permit engines to run in their most efficient and economical speed range. The result is reduced stress and wear—longer life for engines and all power transmitting parts. Thousands of trouble-free, low-cost miles are added to vehicle life. In addition, operating and maintenance costs are held down. Trucks stay on the job, out of the repair shop—and are worth more on the trade-in. Ask your truck dealer to explain how Eaton 2-Speeds pay for themselves over and over.



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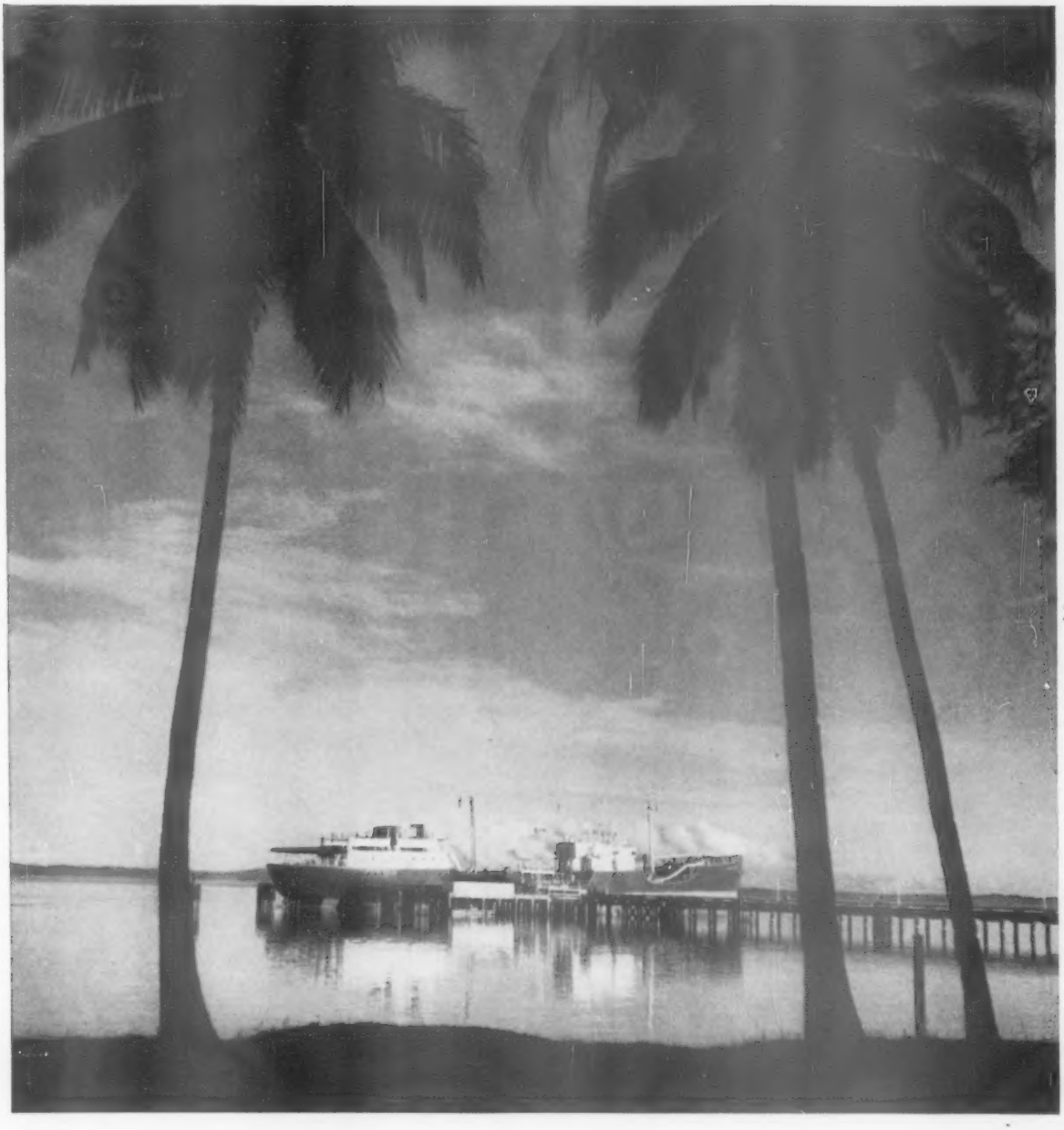
Motor Truck Axles • Permanent Mold Gray Iron Castings • Forgings • Heater-Defroster Units • Automotive Air Conditioning
Fastening Devices • Cold Drawn Steel • Stampings • Gears • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers



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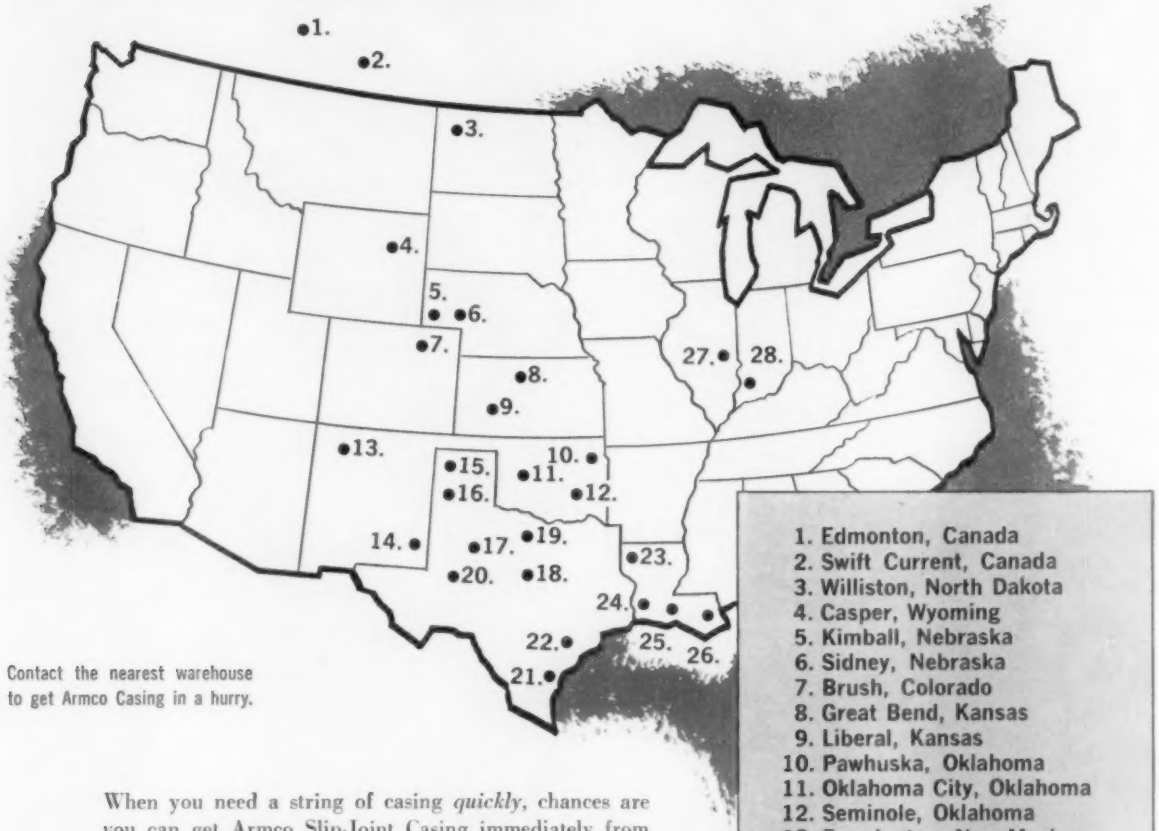
— *Eugene Holman, Chairman of the Board, Standard Oil Company (New Jersey)*

ESSO 75 YEARS

producing energy for an abundant life

STANDARD OIL COMPANY (NEW JERSEY)
AND AFFILIATED COMPANIES

How to get surface casing **in a hurry**



Contact the nearest warehouse to get Armco Casing in a hurry.

1. Edmonton, Canada
2. Swift Current, Canada
3. Williston, North Dakota
4. Casper, Wyoming
5. Kimball, Nebraska
6. Sidney, Nebraska
7. Brush, Colorado
8. Great Bend, Kansas
9. Liberal, Kansas
10. Pawhuska, Oklahoma
11. Oklahoma City, Oklahoma
12. Seminole, Oklahoma
13. Farmington, New Mexico
14. Hobbs, New Mexico
15. Pampa, Texas
16. Lubbock, Texas
17. Snyder, Texas
18. Abilene, Texas
19. Electra, Texas
20. Odessa, Texas
21. Corpus Christi, Texas
22. Houston, Texas
23. Shreveport, Louisiana
24. Lake Charles, Louisiana
25. New Iberia, Louisiana
26. Harvey, Louisiana
27. Clay City, Illinois
28. New Harmony, Indiana

When you need a string of casing *quickly*, chances are you can get Armco Slip-Joint Casing immediately from a nearby warehouse.

Armco Casing is distributed by National Tank Company from 28 convenient locations throughout the oil country. An adequate supply is maintained at these stocking points. When you need direct mill shipments, National's representatives will handle your orders promptly.

Armco Casing offers many advantages to drillers. Long, 40-foot lengths mean fewer joints to handle and weld. The Armco Slip-Joint allows quick stabbing and fast, easy lineup. Diameters range from 6 to 24 inches, wall thicknesses from $\frac{3}{16}$- to $\frac{1}{2}$-inch.

Write us for complete data. Armco Drainage & Metal Products, Inc., Welded Pipe Sales Division, 3717 Curtis Street, Middletown, Ohio • 201 KOME Building, Tulsa, Oklahoma. Subsidiary of Armco Steel Corporation • Export: The Armco International Corporation.

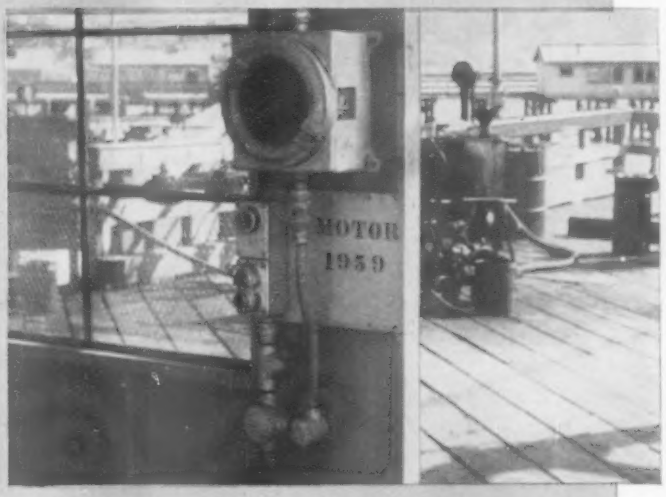
Armco Slip-Joint Casing

Distributed by National Tank Company, Tulsa, Oklahoma. In Canada: National Tank Company, Ltd., Edmonton, Alberta.

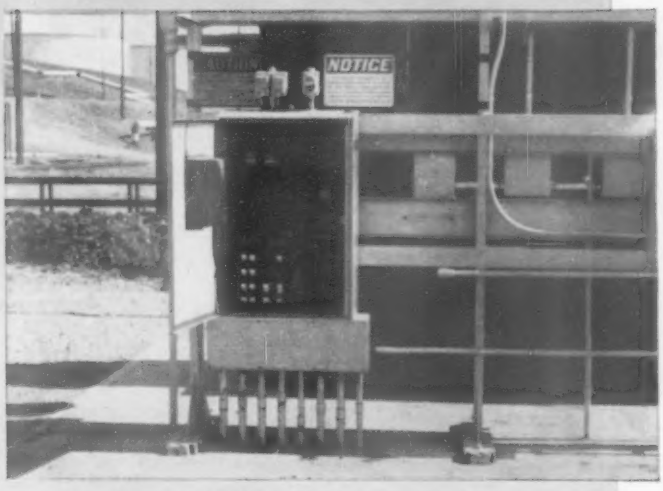
UNION REMOTE CONTROL

for an oil pumping station

speeds up operations—safely



Control Station at the wharf.



Control Station at the storage tanks.

An unusual installation of UNION remote control equipment was recently made for controlling a pumping station at an oil company wharf.

The pumps are used to transport crude oil from a tanker at the dock to refinery storage tanks on land and vice-versa . . . and to move heated fuel oil to a storage tank and then to the ship for its own use. The pumps are located 1700 feet away and 50 feet above the dock.

With this control system the oil lines from the ship are connected to the dock lines. Then an operator simply pushes a button on the dock to activate the small, compact field equipment, located at the pump site in an explosion-proof housing. This action energizes the pump circuits, starting the pumps. The operator can stop the pumps by pressing another button.

A unique feature of the equipment is the protective circuitry and sensing devices which surround the operation with safety. If pressure is lost at the pump, it will automatically shut down. The equipment was designed to be readily adaptable and easily integrated into an already existing communication system.

This is another example of how UNION Centralized Transport Control can be used to make operations faster and more efficient. Write for complete information, Bulletin 1052.

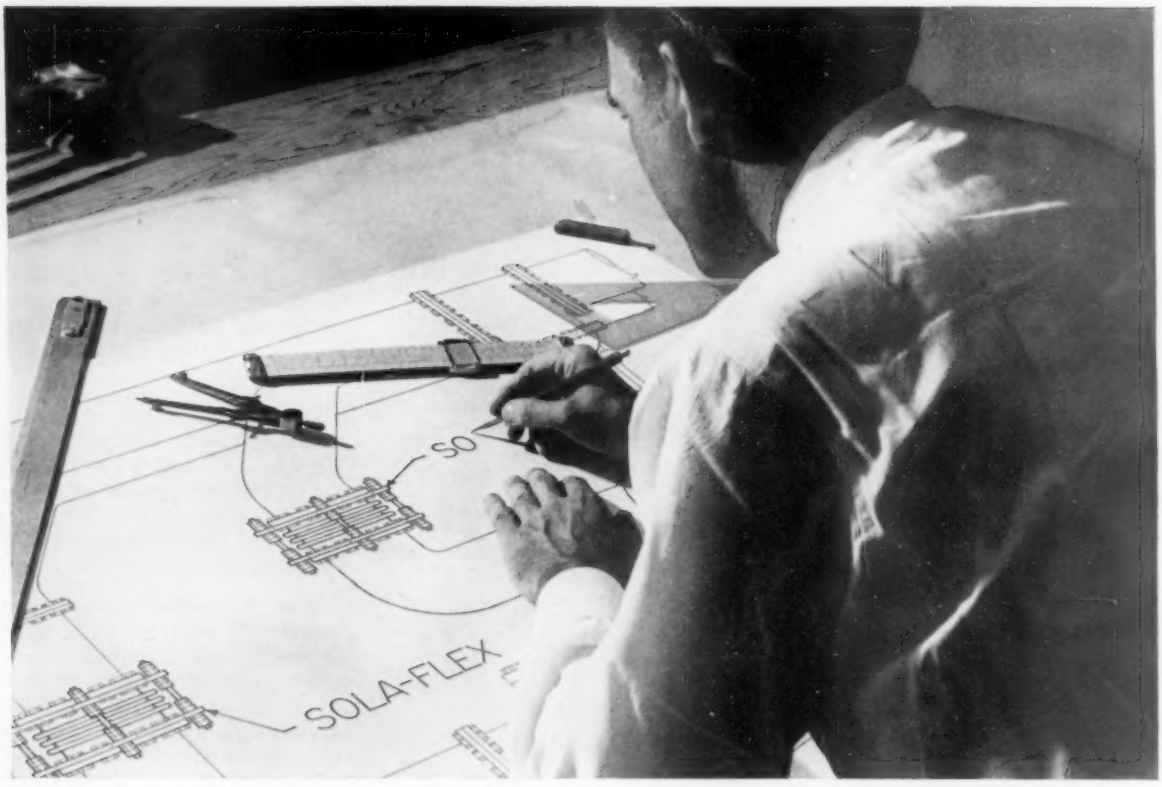
***Quality First . . .* TO LAST**

GENERAL APPARATUS SALES

UNION SWITCH & SIGNAL

DIVISION OF WESTINGHOUSE AIR BRAKE COMPANY

PITTSBURGH 18, PENNSYLVANIA



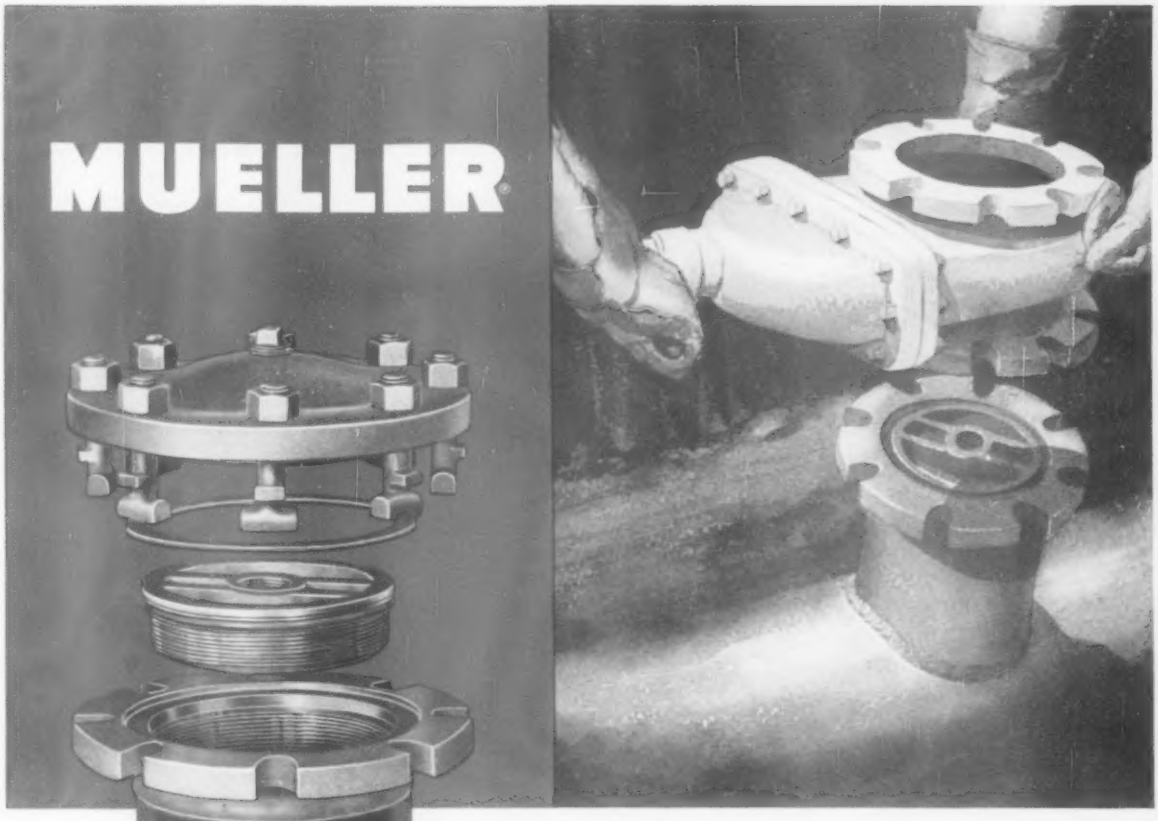
In piping "specs" specify Sola-Flex

YOU BENEFIT many ways when you call for Sola-Flex expansion joints in a high or low pressure piping installation. Durable and economical, Sola-Flex joints are custom-engineered, based on advanced designs perfected by Solar. They are built of a variety of metals in a vast array of sizes, shapes and configurations. And Sola-Flex joints have been proven in service—in all types of installations throughout the petroleum, utility, chemical, petrochemical, and other industries.

Send for the latest Sola-Flex catalog—many pages of valuable data. Write Dept. C-131, Solar Aircraft Company, San Diego 12, California.

SOLAR
AIRCRAFT COMPANY
SAN DIEGO
DES MOINES

Designers, Developers and Manufacturers • Gas Turbines • Aircraft and Missile Components • Bellows • Controls • Coatings • Metal Alloy Products



Money-saving Save-A-Valve Drilling Nipples are available with welding inlet for use with flanged valves in 4", 6" and 8" sizes...with welding or threaded inlet for use with threaded valves in ¾" through 3" sizes.

NO-BLO®

save money... save-a-valve!

You can safely recover expensive valves from temporary or semi-permanent connections with Mueller Save-A-Valve Drilling Nipples.

The NO-BLO® Completion Plug, on 4", 6", and 8" sizes, has "O" Ring Seal and pressure equalizing valve – effectively seals the connection while the gate valve is removed and the nipple is capped. The connection can be used again anytime.

Your Mueller Representative has complete specifications and information on how to save valves and save money with Mueller Save-A-Valve Drilling Nipples – call on him or write direct.

MUELLER CO. **DECATUR, ILL.**

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

MUELLER CO. 100th YEAR SERVING the Water and Gas Industries QUALITY

Since 1857

For catalytic reforming...

Forty refineries specified Clark

User	*Location*	*No. of Units*
Atlantic Refining Company, The	Point Breeze, Pennsylvania	2
BP Refinery (Kent) Ltd.	Kent, England	1
Burmah-Shell Refineries Ltd.	Bombay, India	1
Bahrain Petroleum Company, Ltd., The	Bahrain, Persian Gulf	1
Caltex Petroleum Maatschappij N.V.	Pernis, Holland	1
Compagnie Francaise de Raffinage	La Mede, France	1
Gulf Oil Corporation	Girard Pt., Pennsylvania	4
Gulf Oil Corporation	W. Pt. Arthur, Texas	4
*	Eastern Canada	1
McColl-Frontenac Oil Company Limited	Montreal, Canada	1
Ohio Oil Co., The	Robinson, Illinois	1
Phillips Petroleum Company	Phillips, Texas	1
Phillips Petroleum Company	Kansas City, Kansas	1
Pure Oil Company, The	Smith Bluff, Texas	1
Refineria de Petroleos de Escombreras, S.A.	Cartagena, Spain	2
Shell Oil Company	Wood River, Illinois	2
Shell Oil Company	Deer Park, Texas	1
Shell Oil Company	Houston, Texas	2
Shell Oil Company	Anacortes, Washington	1
Shell Oil Company of Canada Limited	Montreal, Canada	1
Shell (Refining) Australia Pty. Ltd.	Geelong, Australia	1
Sinclair Refining Company	Marcus Hook, Pennsylvania	2
Sinclair Refining Company	E. Chicago, Illinois	2
Societe Francaise des Petroles BP	Dunkirk, France	1
Societe Industrielle Belge des Petroles	Antwerp, Belgium	1
Socony Mobil Oil Company, Inc.	Paulsboro, New Jersey	1
Societe per l'Industria Italiana del Petrolio	La Spezia, Italy	1
Standard Oil Co. of California	El Segundo, California	2
Standard Oil Co. of California	Richmond, California	2
*	Central Kansas	1
Standard Oil Co. of Ohio	Toledo, Ohio	2
Sun Oil Company	Toledo, Ohio	1
D-X Sunray Oil Company	Tulsa, Oklahoma	1
Suntide Refining Company	Corpus Christie, Texas	2
Texas Company, The	Wilmington, California	1
Texas Company, The	Laurenceville, Illinois	2
Texas Company, The	Westville, New Jersey	2
Texas Company, The	Pt. Arthur, Texas	5
Tidewater Oil Company	Delaware City, Delaware	1
Wilshire Oil Co. of California	Norwalk, California	2

*Name furnished on request

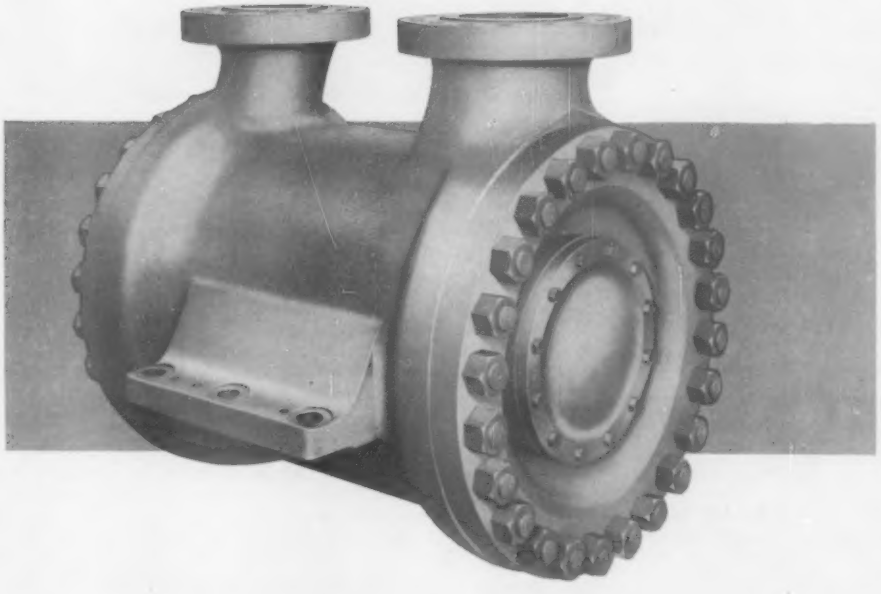
60% choose Clark

Vertically-split centrifugal compressors

Forty major refineries are using or have ordered Clark vertically-split centrifugal compressors for their reforming needs. That's over 60% of the total requiring centrifugal compressors.

We could mention many reasons why these Clark units outsell all other makes combined, but we prefer to let the facts speak for us. Remember 6 out of 10 are Clark . . . how about your next reformer?

CLARK BROS. CO., OLEAN, N. Y.
One of the Dresser Industries
Offices in Principal Cities throughout the World



CLARK® Centrifugal Compressors

Helpful answers to CAUSTIC QUESTIONS

As a leading producer of Caustic Soda, Columbia-Southern is asked many questions every month about this versatile, widely-used alkali. While the answers probably are not completely new to every Caustic Soda user, they do re-emphasize certain basic points that shouldn't be forgotten. We hope that you will find this series interesting and helpfully informative.

What is the necessary raw material for Caustic Soda?

Plentiful supplies of brine are required for the electrolytic production of Caustic Soda. This process also liberates Chlorine as a co-product. An electric current is passed through a sodium chloride brine solution contained in specially-designed cells. A 10-12% Caustic Soda solution forms at the cell's cathode. This low concentration liquor is evaporated to yield the various concentrations desired.

Is Caustic Soda an element?

No. Caustic Soda is a compound of sodium, hydrogen, and oxygen. It is known chemically as sodium hydroxide, and is commonly called lye.

How much liquid Caustic is now produced?

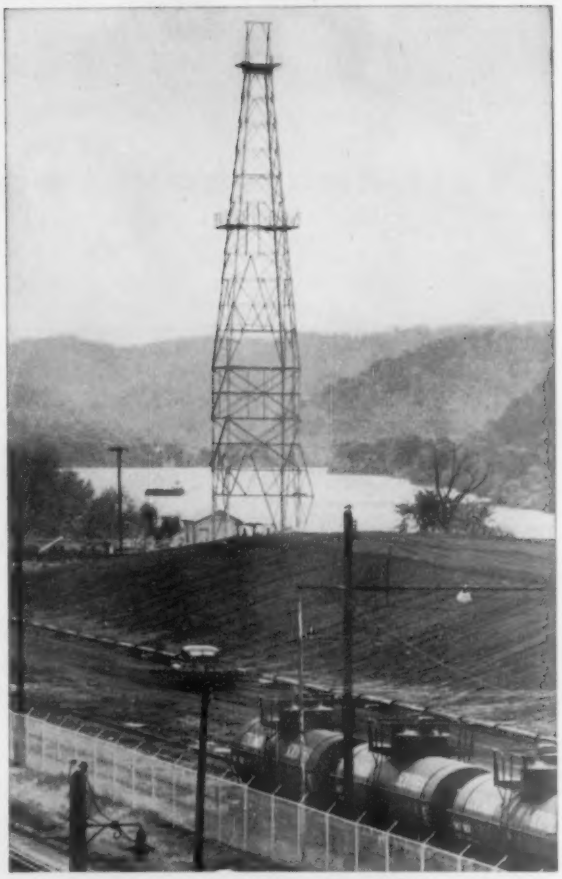
Latest six-month figures for the January-July 1956 period set the production of liquid Caustic at 2,169,368 short tons for electrolytically manufactured, 260,899 short tons for lime-soda process.

What type of pumps are recommended for the transfer of Caustic liquor from tank cars to storage, and from storage to the point of use?

Centrifugal pumps do the job best. All-iron construction with no brass or bronze fittings is generally preferred. For high temperature use, nickel or nickel alloy pumps will give longer service and the liquor will show less metallic contamination.

Who currently uses the most Caustic?

The chemical processing industry itself is by far the largest group user of Caustic, consuming roughly 25% of all production. Rayon and film producers rank second, followed by such large volume consumers as the petroleum refining, pulp and paper, cleaners, soap, textile, metals, vegetable oils, and rubber industries.



SOME OF THE WORLD'S DEEPEST BRINE WELLS, operated by Columbia-Southern to supply the New Martinsville, W. Va., Caustic Soda-Chlorine plant, draw salt brine from depths of a mile and a quarter.

How much water is required to dilute a tank car of 73% Caustic solution to a more easily stored 50% concentration?

About 6,100 gallons of dilution water are needed to bring an 8,000 gallon tank car of 73% down to 50% strength; 7,650 gallons of water to dilute each 10,000 gallon car.

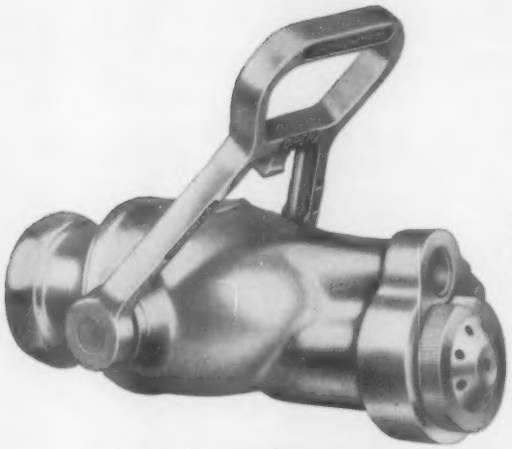
How can each user determine the most economical grade and form of Caustic to buy?

Much, of course, depends upon the user's end product and processing requirements. Solid, standard flake, 50% and 73% solution, all have certain advantages. Processing advances, transportation developments and freight rate changes, however, dictate a periodic review of your purchasing. Columbia-Southern will be happy to look for economies you might well realize . . . at no obligation to you. Call, write or wire our Pittsburgh address for the prompt services of experienced Caustic Soda specialists.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION
SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY
ONE GATEWAY CENTER · PITTSBURGH 22 · PENNSYLVANIA

DISTRICT OFFICES: Charlotte • Cincinnati • Chicago • Cleveland • Boston, Dallas • New York • St. Louis • Minneapolis • New Orleans • Houston Pittsburgh • Philadelphia • San Francisco

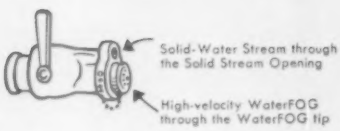
IN CANADA: Standard Chemical Limited and its Commercial Chemicals Division

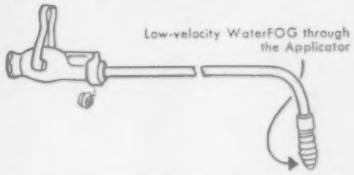


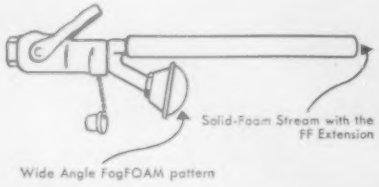
Rockwood SG-60 WaterFOG Nozzle is five nozzles in one

The lightweight Rockwood SG-60 WaterFOG Nozzle *eliminates "special" or single-purpose nozzles!* It actually does the work of five nozzles to put out fires faster, safer and more economically.

Here's what we mean . . .







Here's what you need to put out ordinary combustibles and flammable liquids . . .

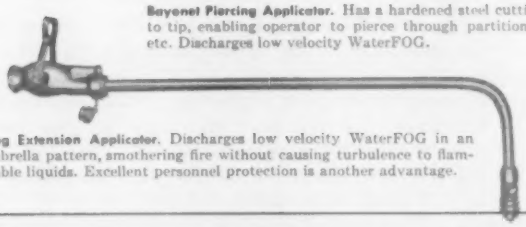
FOAM and "Wet" Eductor with the new FW Metering-Check Valve. Introduces Rockwood FOAM or "Wet" into hose lines, automatically proportioning correct amount of FOAM and "Wet" to water. Also usable wherever one liquid is fed into another on a fixed percentage basis.

Rockwood Double Strength FOAM. Puts out fires in flammable liquids, and in ordinary combustibles, quicker, at lower cost. Three parts FOAM and 97 parts water create a heat-resistant blanket.

Rockwood WET. One part WET mixed with 99 parts water increases water's penetration and extinguishing action. Gives quickest results against deep seated fires. Saves time, water, manpower.

FF Extension Unit. Shown with Type SG-60 Nozzle. Discharges Rockwood FOAM in a solid stream or as Fog-FOAM. Wide angle makes it possible to cover large areas at one time.

Bayonet Piercing Applicator. Has a hardened steel cutting tool attached to tip, enabling operator to pierce through partitions, into interiors, etc. Discharges low velocity WaterFOG.



Long Extension Applicator. Discharges low velocity WaterFOG in an umbrella pattern, smothering fire without causing turbulence to flammable liquids. Excellent personnel protection is another advantage.

ROCKWOOD SPRINKLER COMPANY

Engineers Water . . . to Cut Fire Losses

Distributors in all principal industrial areas

and here's the way to get more information

ROCKWOOD SPRINKLER COMPANY

Portable Fire Protection Division
1589 Harlow Street
Worcester 5, Massachusetts

Please send me your illustrated booklet on Rockwood fire-fighting products.

Name .....

Title .....

Company .....

Street .....

City .....

Zone ..... *State* .....

CF&I WICKWIRE ROPE A CF&I PRODUCT

Your Wickwire Rope Distributor and our metallurgist . . . work together for you

This metallurgist—who is responsible for the quality of our rope wire—is with your Wickwire Distributor every time he makes a call.

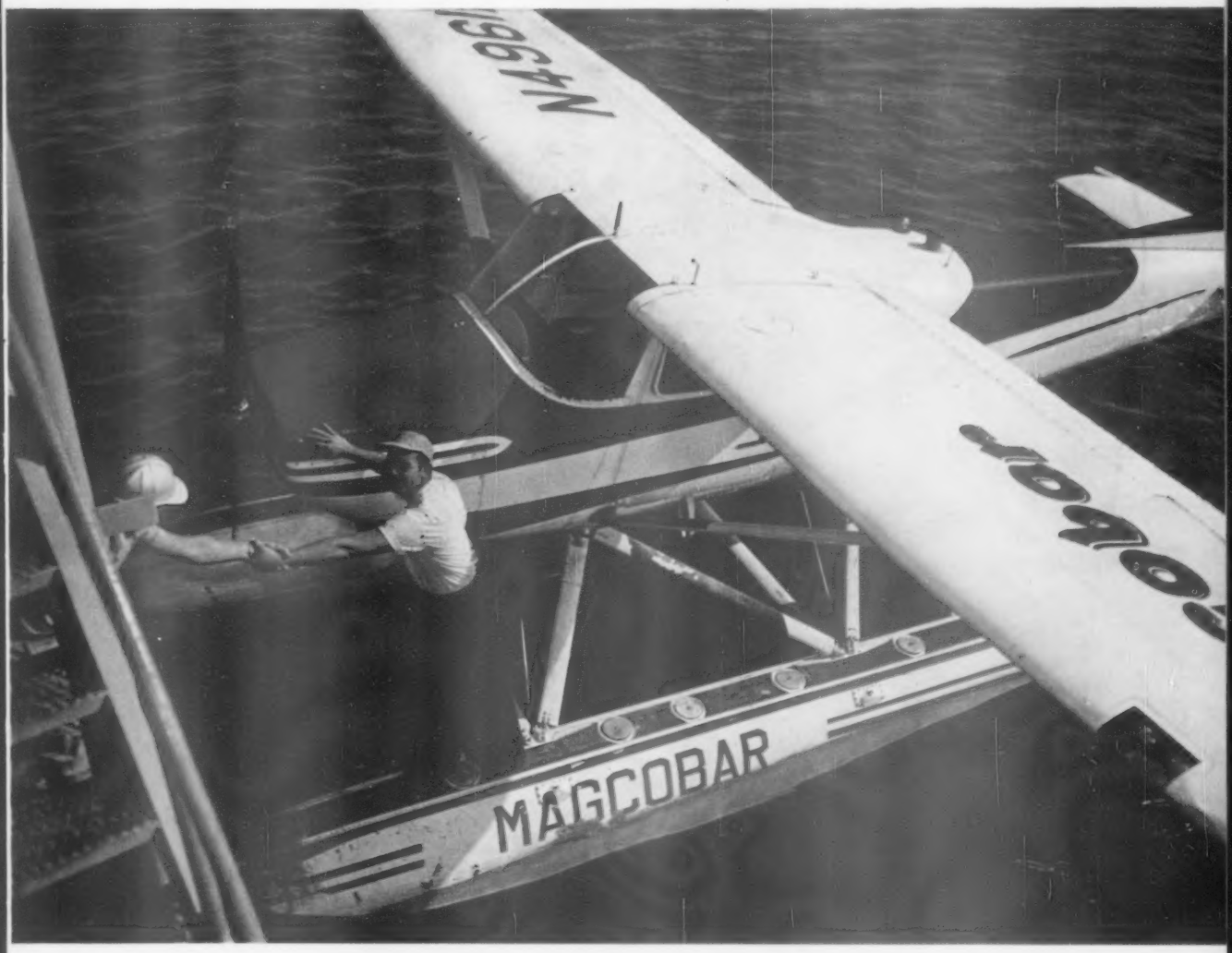
True, he's physically in his laboratory, supervising the thorough testing *of both ends of every coil* of wire to assure uniformity throughout the coil. But, whenever your Wickwire Distributor calls, he has the full assurance that metallurgists like this are constantly making sure that the product has the right chemical and physical properties to give long, dependable service.

It's just one more reason why your Wickwire Distributor knows he's got top-quality wire rope, slings and strand to sell . . . and that these products will serve you well.

4084

A PRODUCT OF THE COLORADO FUEL AND IRON CORPORATION

It takes a complete team to keep dependable drilling mud service available for you



Meet This Magcobar Man, the Flying Mud Engineer . . . whose plane is his office, workshop and laboratory

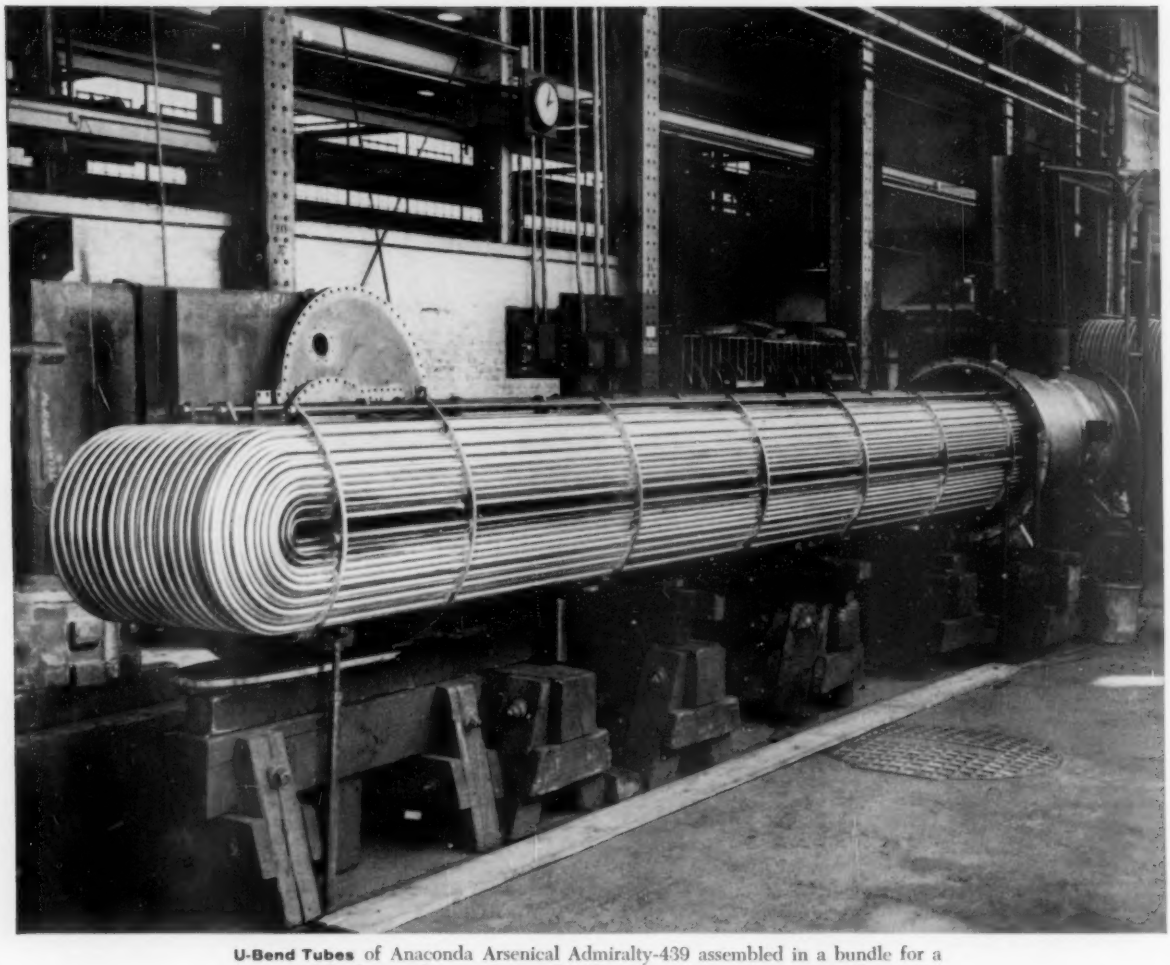
When you call a Magcobar Mud Engineer his first job is to get there fast—and he makes it his business to do just that. Along the Gulf Coast, there is a fleet of fast Magcobar float planes, piloted by Mud Engineers, to serve water locations. These laboratory-equipped planes serve as "home," office and workshop. Other Magcobar engineers use cars, trucks, boats, or walk, if that's the only way to get there. Wherever your drilling location is, in North America, there is a Magcobar Mud Engineer and a Magcobar dealer who combine to give you fast, efficient mud service at your rig.

When you need mud, or mud service, call Magcobar. You'll get the most complete service and finest quality drilling fluids in the oil fields.

MAGNET COVE BARIUM CORPORATION

Houston, Texas

Magcobar
Complete
DRILLING MUD SERVICE



U-Bend Tubes of Anaconda Arsenical Admiralty-439 assembled in a bundle for a horizontal feed-water heat exchanger by The Griscom-Russell Co., Massillon, Ohio.

Arsenical Admiralty U-Bend Tubes make a compact power station feed-water heater

THIS compact tube bundle contains 436 Anaconda Arsenical Admiralty-439 tubes, ⅝-inch OD x .049-inch gage, averaging 45 feet long. The bundle is now operating in a power station feed-water heater.

The American Brass Company is constantly studying corrosion problems affecting condensers and heat exchangers—and is a leader in the development of alloys to help meet these problems. Arsenical Admiralty-439 is but one of its many contributions in the field.

Full Range Available. Anaconda heat exchanger and condenser tubes are made for all sizes and kinds of shell-and-tube, submerged, spray-tower, and finned-atmospheric heat transfer equipment – for operation at elevated temperatures in conformance with ASME standards for allowable stresses.

Technical Assistance. The Technical Department of The American Brass Company is regularly helping manufacturers, power companies, marine operators, petroleum and chemical companies to select the correct tube alloy for many types of condensers and heat exchangers. This service is available to you without obligation. Write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

5783

ANACONDA®

Tubes and Plates for

Condensers and Heat Exchangers

J. R. P.
Here is an inexpensive, rugged forged steel valve that is quality-controlled to meet the highest standards
E. B. J.

ROCKWELL BUILT
Edward Valves

Large size knobbed handwheel eases operation.

Deep, full-size stuffing box and Evalpak packing combine to minimize maintenance.

Swivel disk and radiused stem end prevent galling insure perfect seating

Edward integral Stellited seat and Stellited disk cut repairs sharply.

Straight through flow minimizes turbulance and pressure drop.

All forged construction reduces bulk-eliminates porosity.

We'll be better off using Edward forged valves for all small piping on our job. Let's get a bid.

LIST OF MATERIAL
QUANTITIES ARE FOR 1 GLOBE OR 1 ANGLE VALVE
WHERE A.S.T.M. SPECIFICATIONS ARE INDICATED THE LATEST REVISION APPLIES

PIECE NO.	NAME OF PIECE	NO. REQ'D	MATERIAL	SPECIFICATIONS	CORRESP. MS NO.
1	DISK	1	FORGED ALLOY STEEL STELLITED	A.S.T.M. A182, GRADE F11	727
					485
2	DISK NUT	1	STEEL	A.I.S.I. C1020	23
3	BODY	1	FORGED STEEL (a)	A.S.T.M. A105, GRADE II	111/483
			FORGED STEEL (b)	A.S.T.M. A182, GRADE F11	227/483
4	BONNET	1	FORGED STEEL (a)	A.S.T.M. A105, GRADE II	111
			FORGED STEEL (b)	A.S.T.M. A182, GRADE F11	227
5	GLAND	1	MALLEABLE IRON	A.S.T.M. A220, GRADE 53004	324
6	STEM	1	EVALLOY	AISI GRADE 416	261
7	HANDWHEEL	1	MALLEABLE IRON	A.S.T.M. A47 GRADE 32510	322
8	STEM NUT	1	STEEL	A.S.T.M. A194 - GRADE 1	124
9	YOKE BUSHING	1	BRONZE	A.S.T.M. B62	412
10	PACKING RINGS		EVALPAK	HIGH TEMPERATURE PACKING	501
11	JUNK RING	1	STEEL - EVALUATED	A.I.S.I. C1020	123
12	BONNET GASKET	1	UNOKOTE		505
13	GLAND BOLT WASHER	2	STEEL		
14	GLAND BOLT	2	FORGED STEEL EVALIZED	A.S.T.M. A108, GRADE II	111
15	GLAND BOLT NUT	2	STEEL - EVALIZED	A.S.T.M. A194 - GRADE 0	125
16	TAP END STUD	4	ALLOY STEEL (c)	A.S.T.M. A193	
17	BONNET STUD NUT	4	STEEL (c)	A.S.T.M. A194 -	

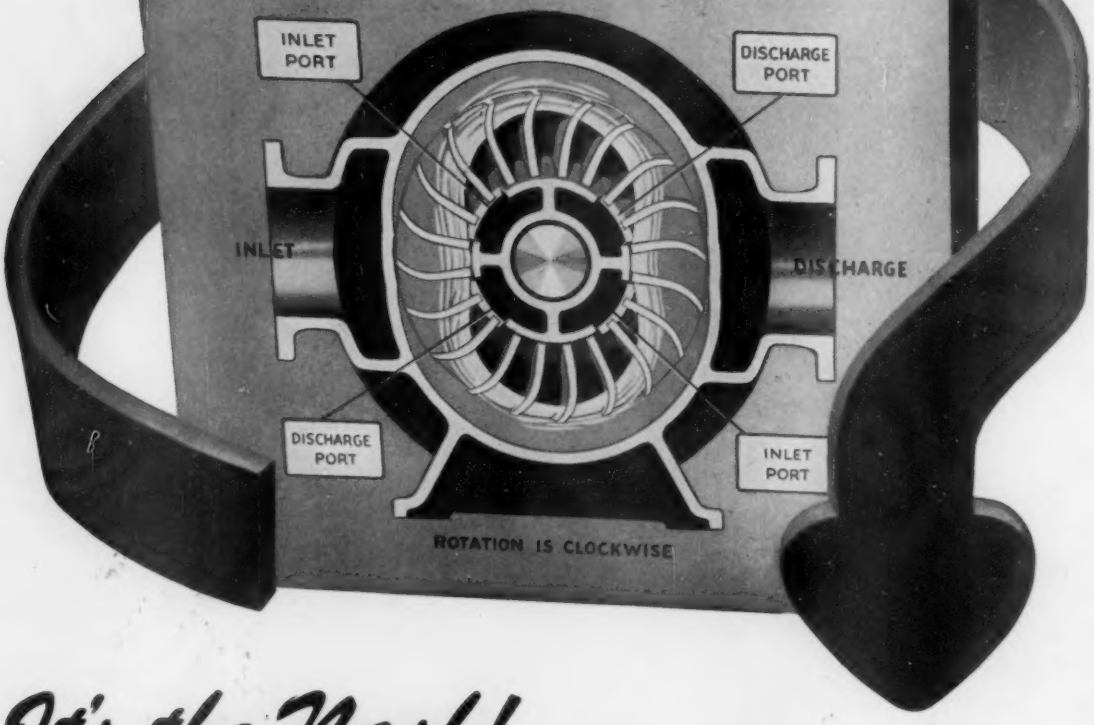
EDWARD VALVES, INC.
SUBSIDIARY OF ROCKWELL MANUFACTURING CO.
EAST CHICAGO, INDIANA

FORGED STEEL
GLOBE AND ANGLE VALVES

DRAWN
CHK'D
APP'D
DATE
DRAWING NO
AE-3529-2

Edward builds Globe and Angle Stop, Non-Return, Check, Stop-Check, Gate, Blow-Off, Mudline, Relief, Hydraulic, Instrument, Gage, and Special Valves and Strainers.

This is Why the Nash is the Most Simple Compressor



It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs pressure in a single stage, with capacities to 6 million cu. ft per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods Data on these pumps sent immediately on request

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature automatically maintained.

Slugs of liquid entering pump will do no harm.

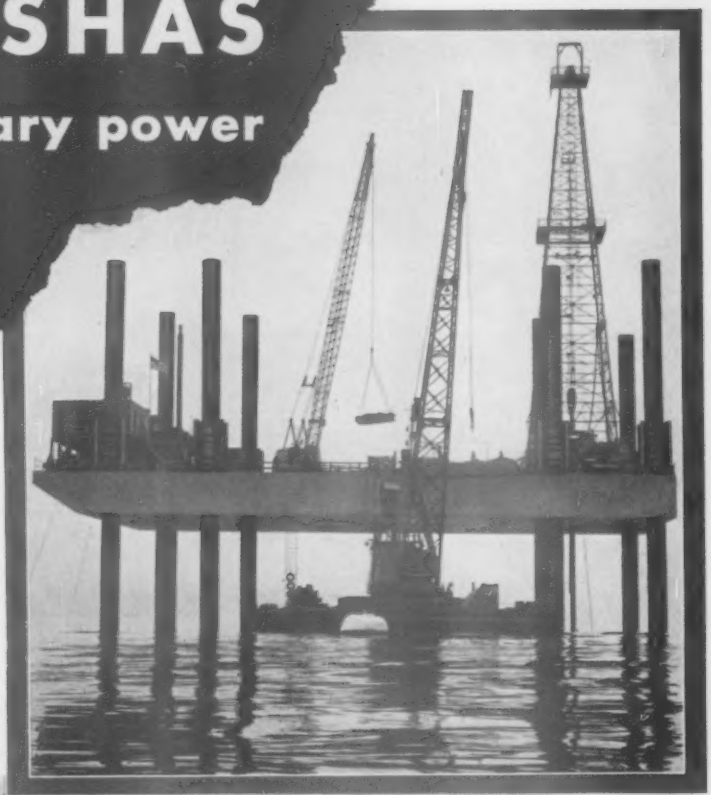
75 pounds in a single stage.

NASH ENGINEERING COMPANY

313 WILSON, SO. NORWALK, CONN.

WAUKESHAS *supply* auxiliary power for Pacific Driller No.1

on first mobile offshore drilling platform to operate off West Coast



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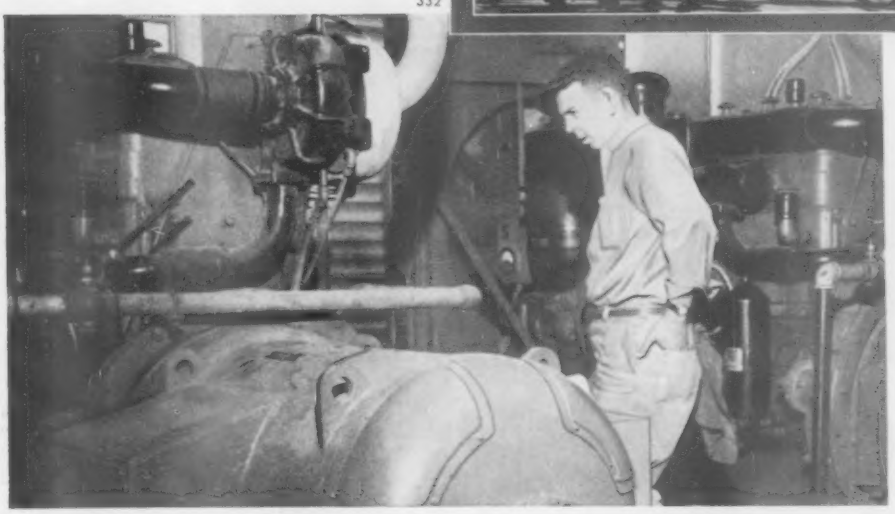

Off HUNTINGTON BEACH, California—about 9800 ft. out, in 60 ft. of water, in State Lease 1552, is Pacific Driller No. 1. Capable of drilling to 20,000 ft. depths, it is owned and operated by Offshore Constructors, Inc. Drilling contractor is Sun Marine Drilling Corp.

●

Auxiliary Power by WAUKESHA TURBI-DIESELS
Two Model WAKDBSU—six cyl., 6¼-in. bore x 6½-in. stroke, 1197 cu. in. displacement—drive two 100 KW generators . . . furnished by Frazier Wright Co.

• TURBO-SUPERCHARGED for greater power at lowest fuel cost—Waukesha Model WAKDBS engines are heavy-duty, six cylinder, four-cycle, full Diesels of 1197 cu. in. displacement, with seven-bearing counterbalanced crankshafts. In their unique, patented combustion chambers, all modern "high speed Diesel fuels" of 45 cetane or better burn cleanly. Starting is prompt, acceleration quick, and performance is lively. The Waukesha exhaust turbocharger system of supercharging increases horsepower with a minimum of parasite load; improves over-all fuel economy throughout the speed range. Get the details in Bulletin 1618. *Waukesha Motor Company, Waukesha, Wis., New York, Tulsa, Los Angeles.*

WAUKESHA Engines and Power Units: 10 hp to 1135 hp—LP Gas • Natural Gas • Normal and Turbocharged Diesels—Get Bulletin 1079

D
No matter
how you figure . . .
Davison's catalysts
give you more!
• Davison gives you quality
• Davison gives you service
• Davison's high stability catalysts save you dollars.
That's why Refinery Men know that when they buy
Davison they buy dependability in service and product.
DAVISON CHEMICAL COMPANY
Division of W. R. Grace & Co.
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Sales Offices: Chicago, Ill.; Houston, Texas; New York, N. Y.;
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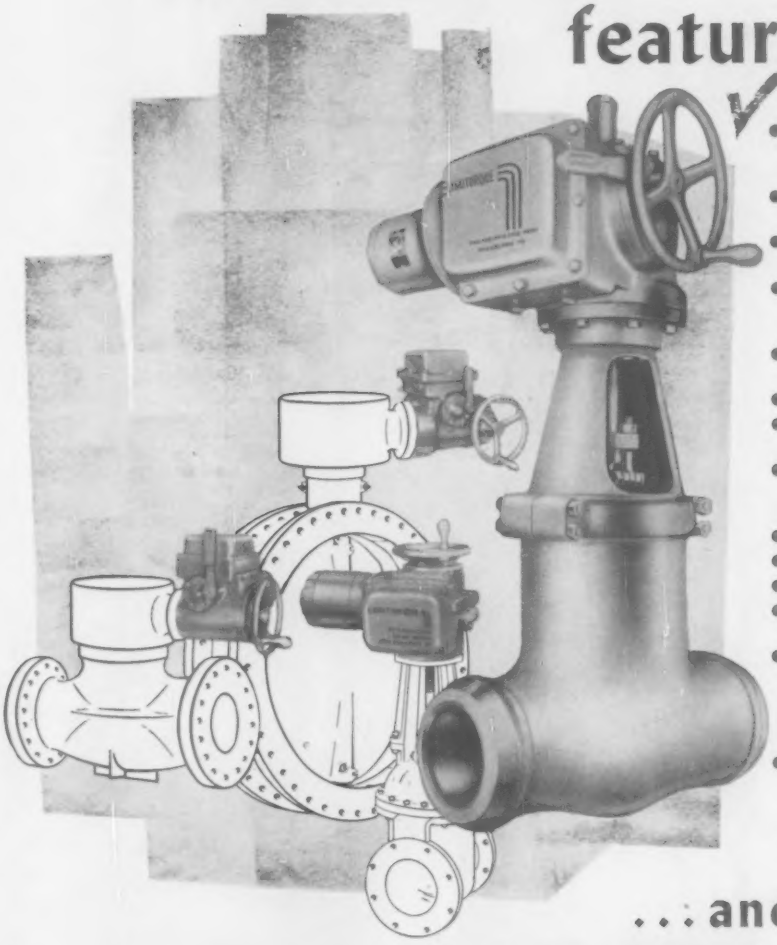
In Canada: Davison Chemical Company Ltd., Toronto
Producers of: Catalysts, Inorganic Acids, Superphosphates, Triple
Superphosphates, Phosphate Rock, Silica Gels and Silicofluorides.
Sole Producers of DAVCO® Granulated Fertilizers.

Check these features



- Micrometer torque seating switch gives tight valve closure, and protects valve parts from damage.
- Self contained unit—no gears, stem nut or bearings to buy.
- Weatherproof, dust-tight, watertight and explosion-proof construction.
- Hammerblow device . . allows motor to reach full speed, before load is engaged.
- Non-rotating handwheel built into the unit.
- Automatic declutching.
- Motor is disengaged during handwheel operation.
- Can always be declutched for handwheel operation regardless of weather or electrical conditions.
- High torque motors.
- Simple valve yoke.
- May be mounted in any position.
- Three to four times faster handwheel operation.
- Actuation may be by any available power source such as electricity, air, oil, gas, water or steam. LimiTorque is readily adapted for microwave control.
- LimiTorque is designed for plug, butterfly, gate and globe valves up to 96" diameter . . . Entire Unit and nut can be lifted off valve yoke, by removing flange bolts.

. . . and you'll understand why more *LIMITORQUE* valve controls are in use than all others combined

Send for new catalog L-550, and please use your Business Letterhead when requesting.

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INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

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Stocked in the Mid-Continent Area by JONES & LAUGHLIN SUPPLY DIVISION P.O. Drawer 2481, Tulsa 2, Okla., and the J & L Store in YOUR field.

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LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO

INDUSTRIAL RUBBER PRODUCTS

Stocked on the West Coast by HENDRIE BELTING & RUBBER CO. 405 Towne Ave., Los Angeles, Calif. PACIFIC COAST RUBBER COMPANY 51 Main St., San Francisco, Calif.

What you need here is an ALDRICH PUMP

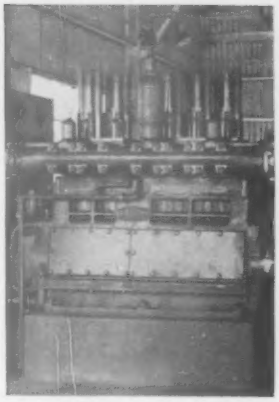
Where pumping operations demand *complete reliability*, Aldrich Pumps assure it—along with unusual freedom from maintenance.

Dependable service. Continuous, heavy duty pumping—at high pressures—is routine with Aldrich Pumps. Aldrich gives dependable low-cost performance in waterflooding, pipe line, gasoline plant, hydrocarbon, injection and petrochemical services. The simplicity of the Aldrich Direct Flow design and the reduced space between valves result in higher volumetric efficiency.

Low-cost maintenance. Fluid end sectionalization, with changeable plunger sizes and interchangeability of parts, means long life and fast, easy maintenance. Parts can be replaced easily and quickly, at low cost. Valves can be removed for inspection or replacement without special tools or equipment. Individual sections of the fluid end can be replaced at a fraction of the cost of conventional type fluid ends.

Get full details. Write for your copy of Data Sheet 100, a condensed catalog and selection table covering our entire line. The Aldrich Pump Company, 9 Gordon Street, Allentown, Pa.

Field parts stock available in Carmi, Ill., Charleston, W. Va., Houston, Los Angeles, Odessa, and Tulsa.



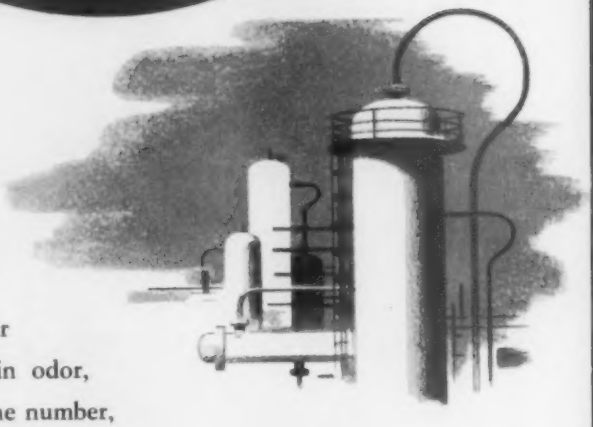
Two Aldrich 3½" x 5" Direct Flow Pumps on lean oil service. Aldrich Direct Flow units are available in 2½", 3", 5" and 6" stroke sizes with 3, 5, 7 or 9 plungers. Sizes range from 25 to 2400 hp.

THE ALDRICH PUMP COMPANY

Versatility

is TRADITIONAL at WESTERN

Versatility
is important in
TREATING



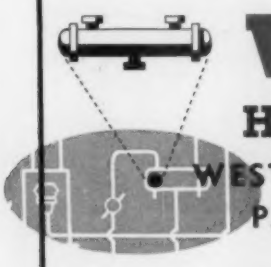
Treating petroleum fractions for the removal of sulphur, nitrogen, oxygen and other contaminants is a versatile hydrogenation process.

With a range of objectives which includes reduction in sulphur and nitrogen compounds—preparation of straight-run or cracked catalytic reforming feedstocks—improvement in odor, color, gum or storage stability, in burning properties, cetane number, lead susceptibility, and susceptibility to catalytic cracking—the equipment used in these process applications must provide an equal range of versatility.

Western Heat Exchangers are closely rated, carefully designed and accurately fabricated to meet the exacting demands of such treating processes—and merit *your* consideration and acceptance.

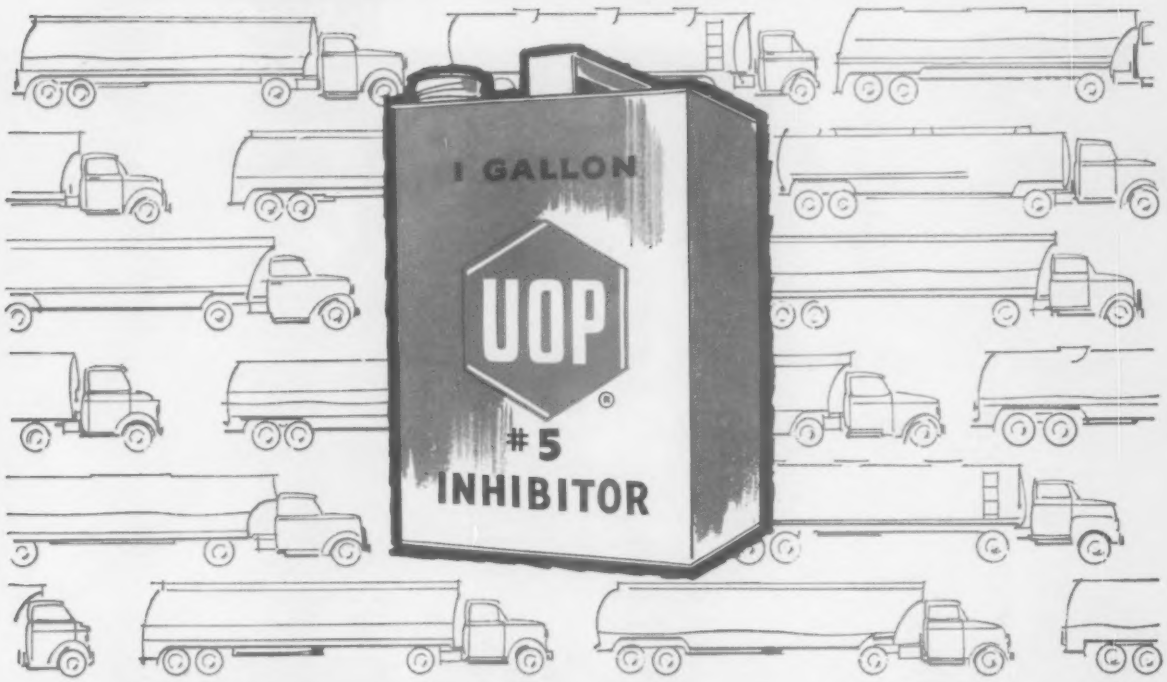
Western Heat Exchangers are used extensively and satisfactorily in hydrogen treating.

Western's representatives are at your command—**immediately.**



WESTERN
HEAT EXCHANGERS
WESTERN SUPPLY COMPANY
P. O. Box 1888 – Tulsa, Oklahoma

IT TAKES ONLY ONE GALLON OF UOP #5...



TO KEEP 100,000 GALLONS OF GASOLINE GUM-FREE

UOP #5 Inhibitor is the most economical you can use. And by experience and test it is also the best—the only inhibitor that can handle the really tough stability jobs.

Actually, only 5 molecules of UOP #5 will protect as many as 1,000,000 molecules of today's tailor-made gasoline from the formation of gum, the one universally recognized cause of engine manifold deposits. It's effective, too, in preventing the decomposition of TEL in stored gasoline. Is it any wonder that UOP #5 is the standard of comparison in the industry?

Just as the methods of making better gasoline keep changing, so do the techniques of finishing gasoline for maximum gum stability and engine cleanliness. We will be glad to share our experience in this field with you in attacking a current stability problem or in reducing costs on present processing. Just write us.

PRODUCTS DEPARTMENT

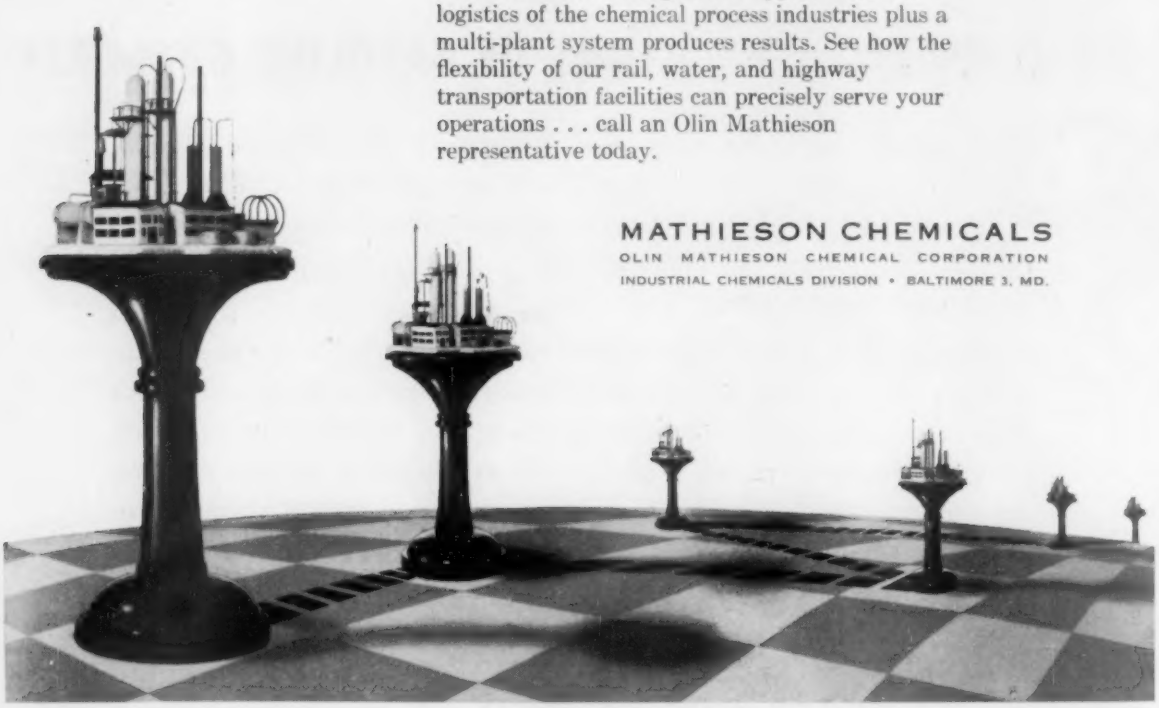
UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD, DES PLAINES, ILLINOIS, U. S. A.

ubiquitous chemicals

Where needed, when needed—maximum dependability of chemical supply is best assured by a multi-plant set-up. It smooths out local shortages and surpluses . . . assures you of shipments on schedules that meet your most exacting requirements.

Olin Mathieson's imaginative approach to the logistics of the chemical process industries plus a multi-plant system produces results. See how the flexibility of our rail, water, and highway transportation facilities can precisely serve your operations . . . call an Olin Mathieson representative today.



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INDUSTRIAL CHEMICALS DIVISION • BALTIMORE 3, MD.

MATHIESON

INORGANICS: Ammonia • Bicarbonate of Soda • Carbon Dioxide • Caustic Potash • Caustic Soda • Chlorine • Hydrazine and Derivatives • Hypochlorite Products Muriatic Acid • Nitrate of Soda • Nitric Acid • Soda Ash • Sodium Chlorite Products • Sulphate of Alumina • Sulphur (Processed) • Sulphuric Acid • **ORGANICS:** Ethylene Oxide • Ethylene Glycols • Polyethylene Glycols • Glycol Ether Solvents • Ethylene Dichloride • Dichloroethylether • Formaldehyde • Methanol • Sodium Methylate Hexamine • Ethylene Diamine • Polyamines • Ethanolamines • Trichlorophenol

4688

result of an engineer's good common sense

Pre-fabrication saves time, space and money when B&W Seamless Welding Fittings are used!

The engineer on this job knows his business. He specified B&W Seamless Welding Fittings and arranged for pre-fabrication. Think of the time, space and money he's saving management.

And there's no question of the pre-fabricated sections fitting when they're ready to be installed, because they're dimensionally accurate. Full radius, true circularity and smooth walls of exact thickness permit fast alignment and easy fit-up.

This time, specify B&W Seamless Welding Fittings for a permanent, leakproof piping system. Seamless Welding Fittings allow piping to nest closer, are stronger, yet weigh considerably less than other types of fittings. They're available in a complete range of sizes and types in carbon and the B&W CROLOYS.

THE *NATURAL* SOURCE FOR ALLOY FITTINGS

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THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION • FITTINGS DEPARTMENT
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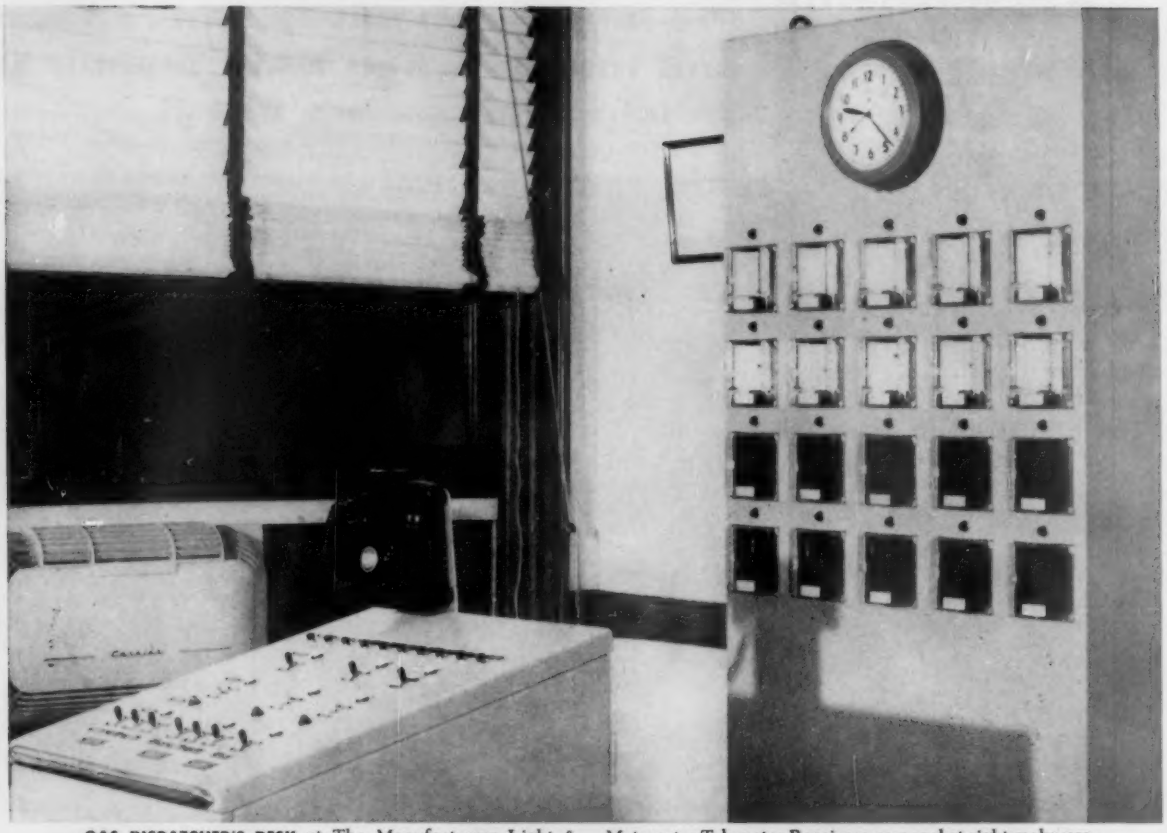
Seamless welding fittings and forged steel flanges, seamless and welded tubular products — in carbon, alloy and stainless steels.



GAS DISPATCHER'S DESK at The Manufacturers Light & Heat Company's Pittsburgh office. The miniature Bristol Metameter Telemeter Receivers on panel at right make possible this ultra compact installation.

New miniature telemeters!

BRISTOL instruments make possible complete installation in small space.

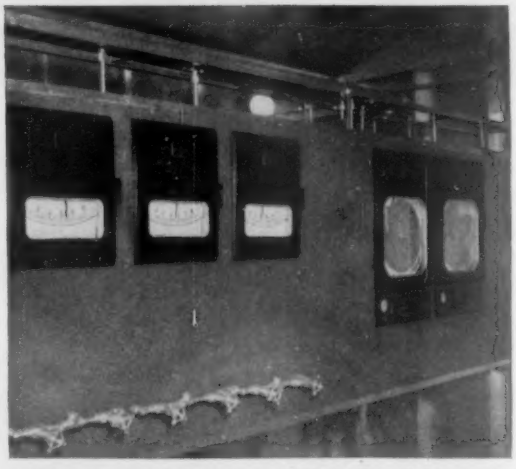
Gas dispatcher at Manufacturers Light & Heat Co., Pittsburgh, Pa., does a full-sized job *in a fraction of usually required space.*

The miniature Bristol Metameter Telemeter Receivers in this highly integrated, compact station give the gas dispatcher eight continuous pressure readings from three remote regulator stations—from 7 to 30 miles away. Switches on the console let the dispatcher raise or lower the downstream pressure at any stations.

And all this in the office space taken up by two stenographer's desks!

Bristol Metameter® Telemeters—full-size or compact—can solve your remote measurement and automatic control problems as they have for hundreds of users in utilities, pipeline companies, and manufacturing industries. You'll find a Bristol system for every application: pressure, vacuum, liquid level, flow, temperature, static and differential pressure, motion, voltage, current, power and totalized load. For complete information write: The Bristol Company, 120 Bristol Road, Waterbury 20, Conn.

6.59

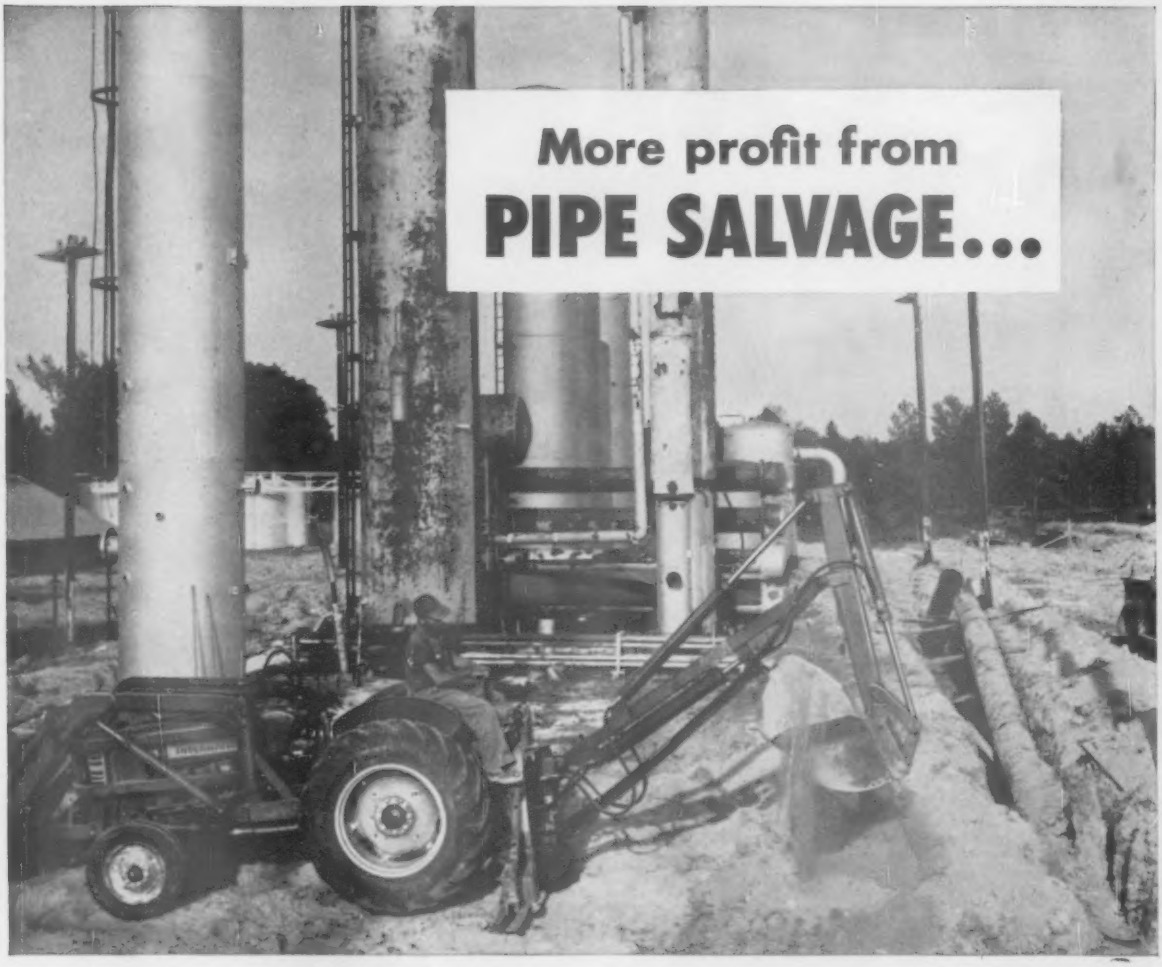


REMOTE REGULATOR STATION. Three Bristol Metameter transmitters (left) and two Bristol Series 500 pneumatic controllers transmit data to dispatcher—miles away—and automatically carry out his instructions.

BRISTOL

TRAIL-BLAZERS IN PROCESS AUTOMATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS



with an INTERNATIONAL® 350 Utility tractor

Salvaging a web of criss-crossed pipe in soil dense-packed by years of refinery operation takes a tractor with *brawn!* It takes a tractor with built-in weight and strength to make the backhoe bucket bite and fill on every digging stroke.

The new International 350 Utility gives you this strength and stamina, with up to 1,000 pounds greater weight—capacity to boost trenching yardage as much as 25 per cent. Greater power and weight also provide *traction* to bull loader buckets full. Integral *power steering* gives easy, one-hand maneuverability, even with a heaped half-yard loader bucket. *So try it* . . . you'll *outwork them all* with a new International 350 Utility!

There are over 5,000 IH Dealers to give prompt sales-service *wherever* your jobs are located. The one closest to you will be glad to demonstrate. Look in the classified directory . . . phone today!

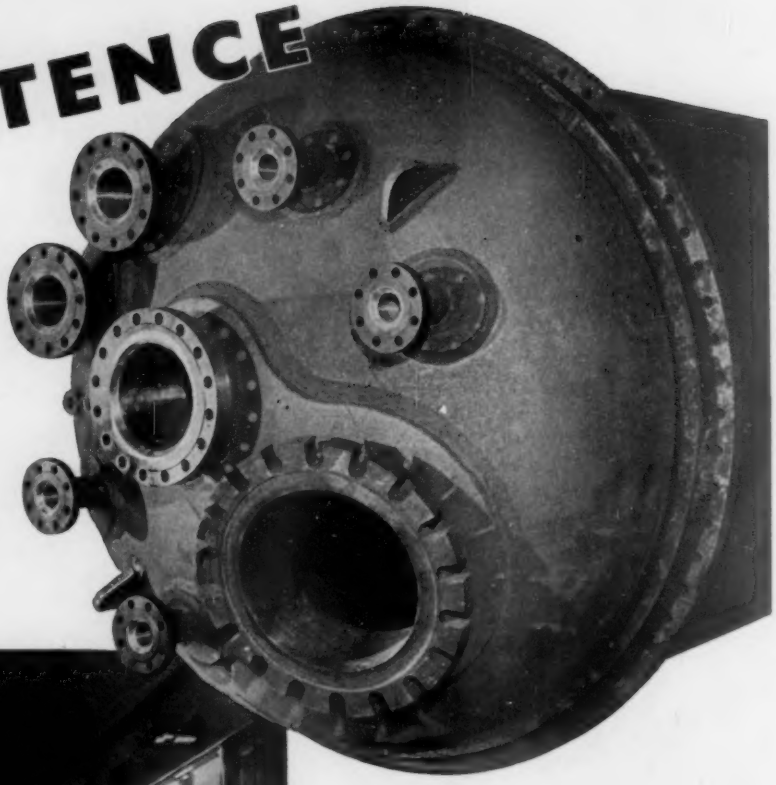
IH® SEE YOUR

INTERNATIONAL HARVESTER DEALER

International Harvester products pay for themselves in use—McCormick Farm Equipment, Farmall and International Tractors . . . Motor Trucks . . . Construction Equipment—General Office, Chicago 1, Illinois

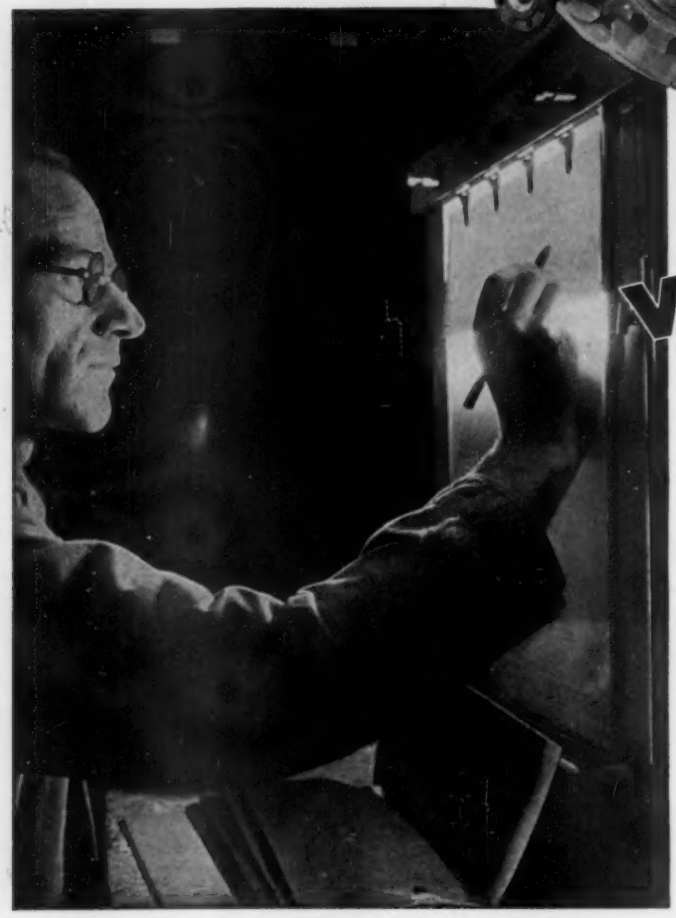
Rock-bottom trenching cost is yours with an International 350 Utility and rear-mounted trencher. Digs trenches 5 to 14 inches wide, as deep as 6 feet for field collector lines. Variable speed drive, 0 to 600 feet per hour.

COMPETENCE



Head of a 6 ft. dia. Autoclave spun on the Harvey "Rotarpress" from a stainless steel disc 1⅝" in thick.

Designed for a working pressure of 500 lbs./sq. in.



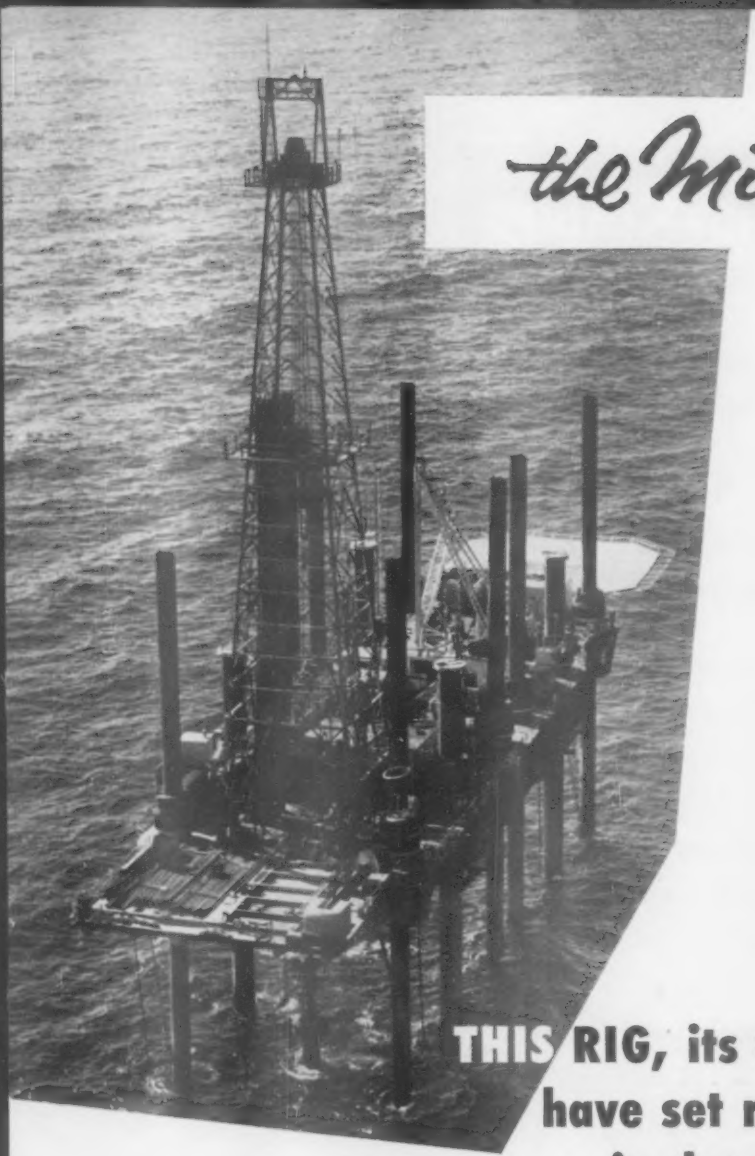
VIGILANCE

KEYNOTES OF

Harvey

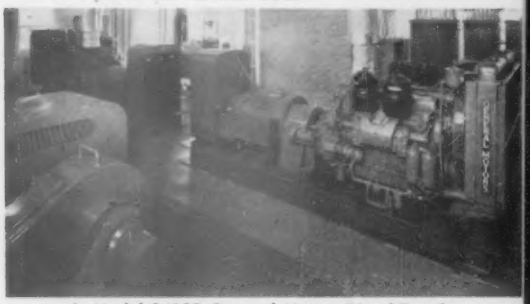
FABRICATION

G. A. HARVEY & CO. (LONDON) LTD., Woolwich Road, London, S.E.7 England. Cables: 'Cheaper, London'



the Mighty "Mr. Gus"

2—of the four Model 12-GD 150 Stewart & Stevenson AC Generator Sets which provide AC power for the MR. GUS.



4—Model 24103 General Motors Diesel Quads furnish power for the National 130 Drawworks and 3—National Model E-500 Mud Pumps.

THIS RIG, its crew, and the engines have set record after record in deep water drilling

After almost 2 years of service under almost every kind of hazard, the C. G. Glasscock rig, *MR. GUS*, has proved its might.

Operating today on its ninth well in 93 feet of water and nearly 70 miles from shore, this rig has stood the test of wind and sea. Second only to the people behind this enterprise, the engines—which provide the might for the *MR. GUS*—are largely responsible for the successful record of this stupendous operation.

Power for all operations on this largest of offshore drilling rigs is provided by dependable General Motors Detroit Diesel Engines. A total of more than 4500 horsepower in series 71 GM Diesel Engines supply power for everything from the drilling rig to power for the galley sink. These engines have already chalked up more than 12,000 operating hours with absolutely no major repairs.

It's no wonder that the management of C. G. Glasscock has again for the 9th consecutive year selected GM Detroit (Multiple Engine) Diesels from Stewart & Stevenson Services . . . this time for an even more powerful and larger offshore drilling rig, the new *MR. GUS II* which will receive its power from over 5000 Rigelectric* horsepower.

The unparalleled background of experience which Stewart & Stevenson has in complex power application can help you reduce operating costs. For straight mechanical drive or diesel electric, it will pay you to consult Stewart & Stevenson before you select any drilling rig power.

STEWART & STEVENSON SERVICES, INC.

Main Office and Plant: 4516 Harrisburg Blvd., Houston 11, Texas. Phone CApitol 5-5341

Branches: Corpus Christi, Dallas, Lubbock, San Juan, Odessa

Representatives: San Antonio, Longview, Brownsville, Tyler, Pecos

*"RIGELECTRIC" REGISTERED TRADE MARK FOR STEWART & STEVENSON DC DRILLING RIG POWER

STEWART & STEVENSON

THE NATION'S LARGEST DISTRIBUTORS OF GM DIESEL ENGINES

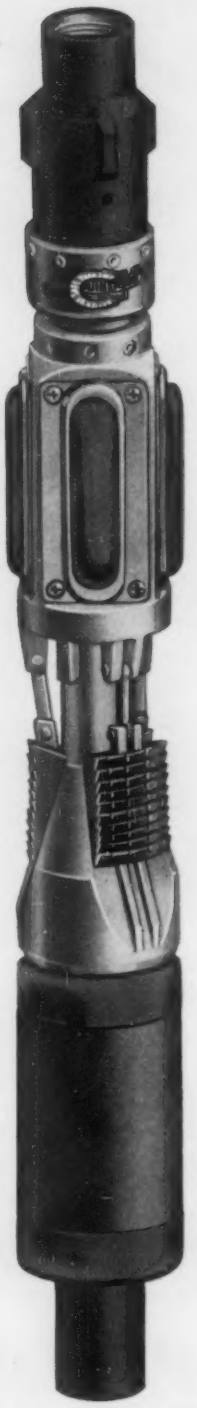
Short Length... Long Service

GUIBERSON AF PACKER

for acidizing, flooding, fracturing and other below packer pressure operations

The solid head packer you've been wanting a long time and at a price you'll be glad to pay. The AF is short, compact, strong and reliable in operation. Positive seal of pressure below the packer at any depth. Design features include friction pads, automatic latch and dove-tail slips and head. Special rubber has built-in ability to return to original shape. It will not vulcanize to casing wall and is acid, oil and gas resistant. Best of all, here is a packer you can handle—in the well or out! Over-all length of 5½" or 7" size is less than four feet!

See this packer at your favorite supply store.



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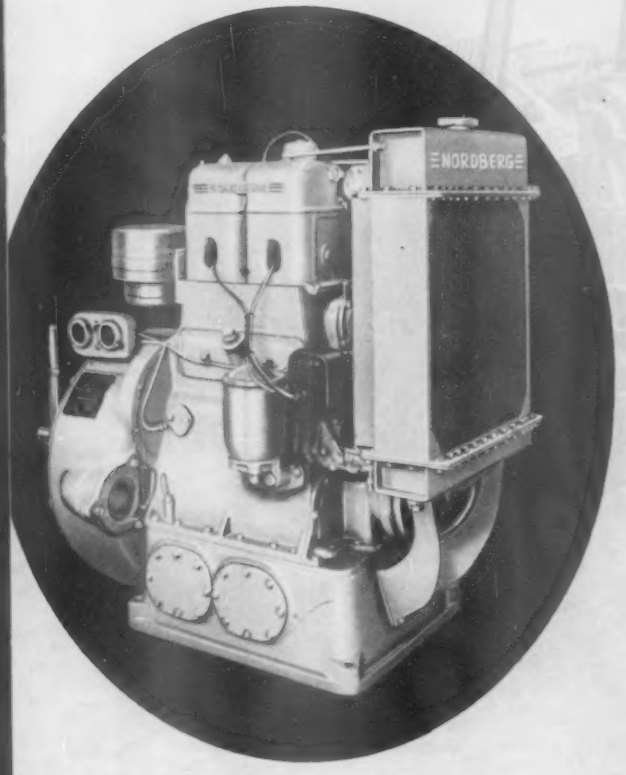
POWER CHIEF®

OIL FIELD ENGINES



• Nordberg Power Chief Gas Engines are now built in compact single-cylinder and two-cylinder sizes, rated from 18 to 36 horsepower at medium speed to handle a wide range of pumping requirements.

. . . setting new records for 'round-the-clock PRODUCTION PUMPING

• Before you consider *any* production pumping engine, it will pay you to consider that Nordberg *Power Chief* Gas Engines are setting new records for 'round-the-clock service. Many actual *Power Chief* case histories show over 30,000 hours of continuous pumping operation—*with original rings, pistons, liners, bearings and crankshaft still in place!*

Here, then, is positive proof that Nordberg *Power Chief* engines really deliver the kind of rugged, day-in, day-out power you need for dependable production pumping service at the very lowest maintenance cost.

For further details, mail the coupon today.

NORDBERG MFG. CO., Milwaukee, Wisconsin

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IN-MAR CO., Wilmington, California

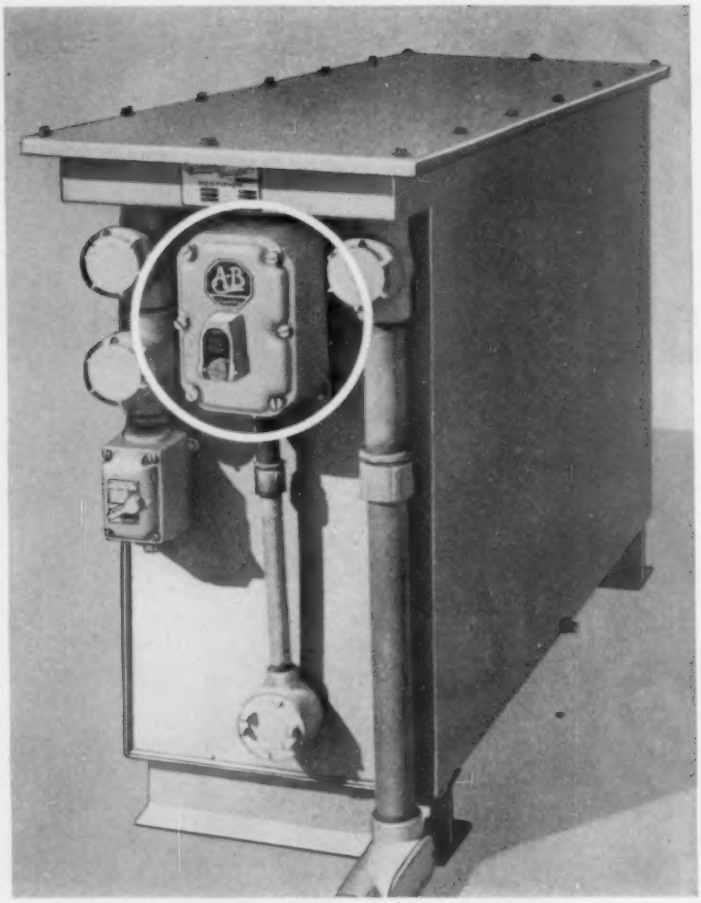
STEPHENS OIL FIELD REPAIR, Fairfield, Illinois

MEAD ENGINE & WELDING WORKS, Sterling, Kansas

CORNELISON ENGINE MAINTENANCE CO., INC., Seminole, Oklahoma

ROGERS DIESEL ENGINEERING CO., New Orleans, La.

The Sign of
QUALITY
MOTOR CONTROL



This rectifier for a gas treating plant has an Allen-Bradley manual motor starter in a NEMA Type 7 explosion-proof enclosure.

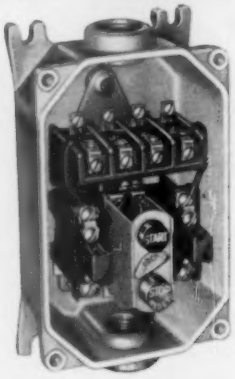
The silver alloy contacts are always in perfect operating condition. The overload breakers are not affected by time or atmospheric conditions—your motor is always reliably protected. You can install these starters . . . and forget them. Send for Allen-Bradley Handy Catalog.

MANUAL MOTOR STARTERS

for Outdoor, Weatherproof, and Explosion-proof Service

This Bulletin 609 Size 0 manual across-the-line starter is in a NEMA Type 1 general-purpose enclosure, with 2 thermal breakers for dependable overload protection.

Bulletin 609 manual starter in a NEMA Type 4 watertight enclosure. Cover gasket makes a watertight seal. Conduit connections are threaded into cast-iron base.



Cover removed to show mechanism. All Bulletin 609 switch mechanisms open and close with a quick-make, quick-break action. Operator cannot "tease" contacts.

This is the Bulletin 609 manual starter in NEMA Type 7 explosion-proof starter. Cover and base have machined surfaces for tight seal in hazardous atmospheres.

Allen-Bradley Co.
1304 S. Second St.
Milwaukee 4, Wis.

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SOLENOID MOTOR CONTROL
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advanced design in turbochargers means... air-cooling!

AiResearch turbochargers possess this all-important characteristic

There's little quarrel in the diesel industry about the air-cooling principle being highly-desirable in a turbocharger. It eliminates the need for extra plumbing on installation, puts no additional burden on an engine's cooling system and makes for a lighter, smaller unit in relation to output.

AiResearch turbochargers now available have been designed on this principle — which promises to be universal in the future. In addition, our units increase power up to 100% depending on design and application of your engine, cut fuel costs, reduce noise and decrease or eliminate smoking. The removable rotating assembly makes them easier to maintain than other turbochargers.

We invite your inquiry on how you can improve the performance of your diesels by the application of our turbochargers.

BASIC SPECIFICATIONS FOR AIRESEARCH TURBOCHARGERS

MODEL	T-10	T-14	T-15	T-30-2	T-30-6
Diameter — in. nom.	9	11.5	15.25	15.25	16
Length — in.	9	14.12	16.75	17.25	21.75
Weight — lb.	40	95	125	135	195
Output — lb/min. (Standard Conditions)	25-40	35-65	35-65	70-95	115-175

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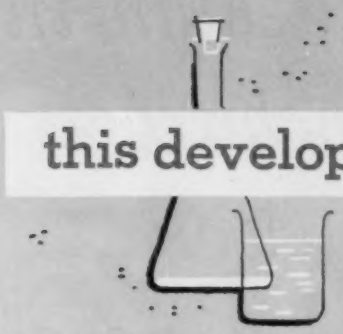
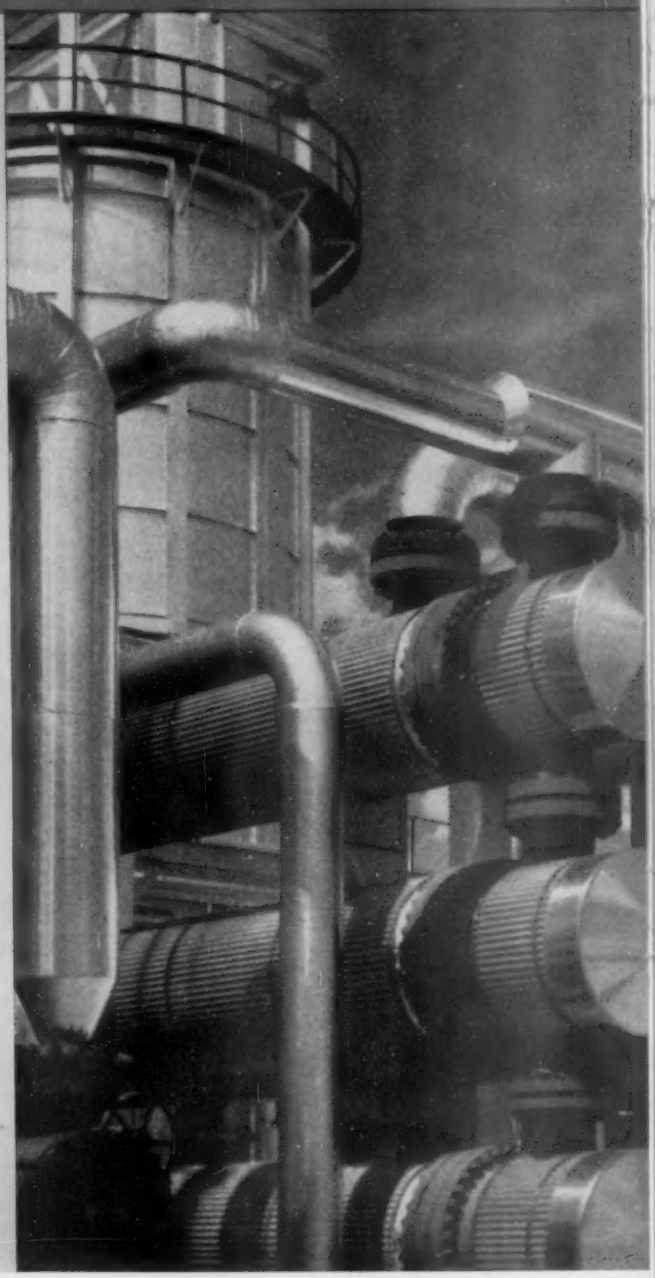


this development of a research idea . . .

helps make



This picture shows the business end of a bright idea for gasolines. It is the heart of the UOP Rexforming process, a new development in petroleum refining that produces automotive gasolines with the industry's highest octane ratings.

The idea was born in our research laboratories. The equipment necessary to make the process commercially practical was developed by UOP design and process engineers.

A lot of scientists, technicians and engineers spared neither brains nor labor in bringing this idea to its successful practical application. And back of it all was the basic purpose of making the gasolines you sell meet today's demand for more efficient motor fuels and perfecting the methods to make its manufacture efficient and economical.

Not only at UOP, but throughout the petroleum industry "men of science" are constantly working to provide the "men who sell" with more marketable products from petroleum. They, too, have an important part in the great economic process of creating demand by making supply more salable.

UOP has prepared an interesting booklet on "How Men of Science Help You Sell". We'll be glad to send you a copy on request.

UNIVERSAL OIL PRODUCTS COMPANY

UOP®

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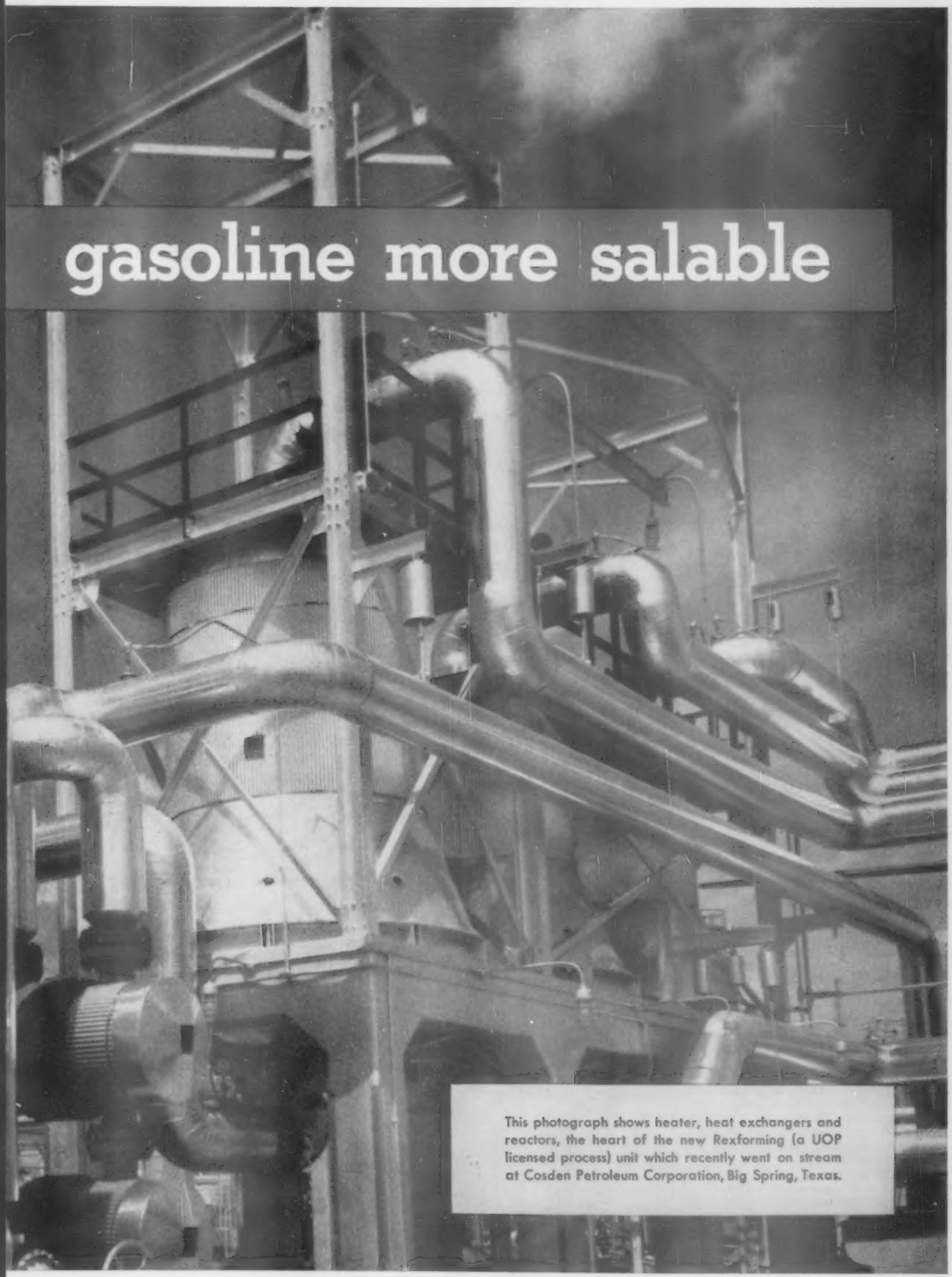
Des Plaines, Illinois, U. S. A.

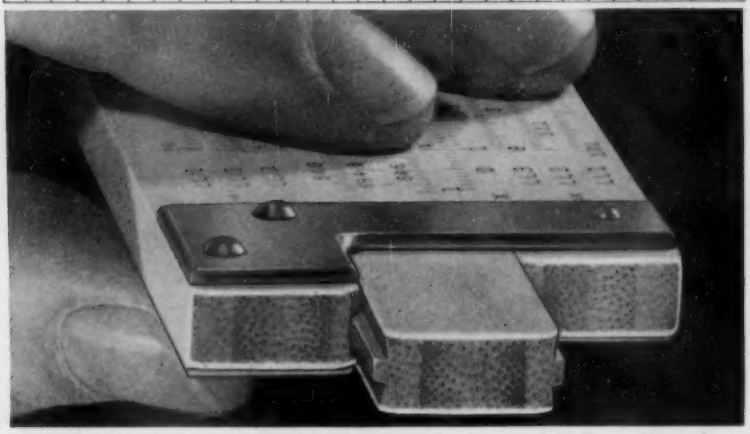
Forty Years Of Leadership In Petroleum Refining Technology

gasoline more salable



This photograph shows heater, heat exchangers and reactors, the heart of the new Rexforming (a UOP licensed process) unit which recently went on stream at Cosden Petroleum Corporation, Big Spring, Texas.

DRAFTING TRENDS



Magnified view of the laminated bamboo construction used in Post slide rules.

Why the trend to bamboo construction?

Due to its unique characteristics, bamboo is an especially suitable base material for various unusual applications. For example, experience over many years has proven bamboo's properties are ideal for slide rule construction. Here are some of the most outstanding reasons why the growing trend is to bamboo rules:

Bamboo gives smoother operation

Slide rules of other materials often require use of lubricants to insure smooth sliding. Bamboo avoids messy additives because it has natural, sealed-in silica particles that provide *self-lubrication.* The longer you use a bamboo rule, the easier it is to operate.

Bamboo holds its dimensions, retains its accuracy

Even in hot, humid weather, laminated bamboo slide rules resist expansion better than any other material. This dimensional stability assures consistently accurate readings.

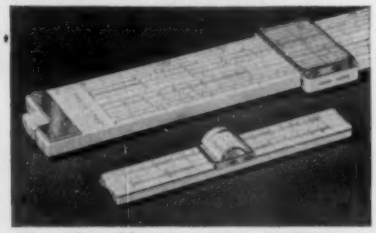
Recognizing the advantage of bamboo, Post uses it exclusively for slide rule construction. To the basic advantages of bamboo, Post has added several other features that further improve slide rule accuracy and dependability. For example, graduations are "engine-divided." Every marking is cut into the snow white celluloid face with a machine controlled knife edge. "Engine-divided" scales are easy to read, unfailingly accurate and last the lifetime of the rule.

Even the metal bound cursor on Post slide rules is designed for accuracy. A tiny, hidden spring keeps a perfectly vertical hairline.

Recent slide rule advancement

The latest development in bamboo slide rules was the introduction of Post's Versalog rule five years ago. This precision instrument meets the exacting demands of modern research, engineering and design. It features greater accuracy (four times greater in square root determination), color coding of trigonometric scales, new end zone designations for faster and surer computations, and more convenient arrangement of LL scales.

Probably the handiest bamboo slide rules made are Post's Vest Pocket rules. One has a 5″ scale, the other a 4″ scale with a magnifier as standard equipment. They are perfect for fast, spur-of-the-moment calculations.



(Top) *Post Versalog slide rule* (Bottom) *Post 1441 Vest Pocket slide rule*

For a free catalog describing Post bamboo slide rules, see your Post dealer or write today to the Reader Service Division of Frederick Post Company, 3644 N. Avondale Avenue, Chicago 18.

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SENSITIZED PAPERS & CLOTHS • TRACING & DRAWING MEDIUMS • DRAWING INSTRUMENTS & SLIDE RULES
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They Say—

Oklahoma Allowable Plays Favorites

"It is unfortunate when Oklahoma was the pioneer in oil and gas legislation that it now refuses to modernize the oil and gas laws. There is no longer any incentive to drill a well. The allowables favor the stripper.

R. V. RODMAN

"There is no oil from Oklahoma that goes farther east than Lima, Ohio. The reason for this is that the people who control the imports—the big companies—control the pipelines."

Roland V. Rodman, president, Anderson-Prichard Oil Corp., at a press conference of Independent Petroleum Association of America executives.

Atomic Competition With Oil

"The developments in uses of atomic power are astounding. On the other hand, as long as liquid fuels are available at reasonable cost, it is difficult to see how the demands for such fuels will fail to continue to be very large.

"As we see it now, atomic energy is more likely to be used within the foreseeable future to produce electrical energy.

"Any serious inroad of atomic power in the U. S. is expected only in the far distant future."

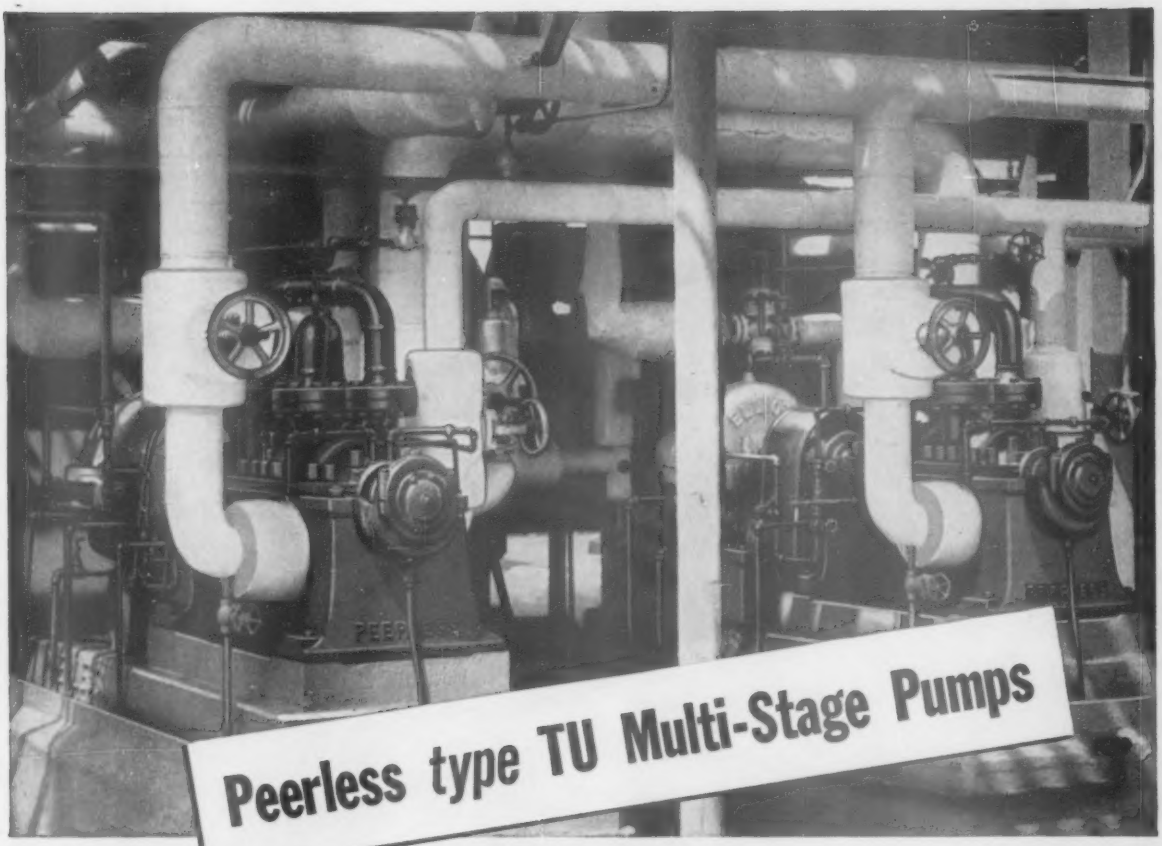
Dr. Warren K. Lewis, Massachusetts Institute of Technology, addressing an M.I.T. regional conference, Tulsa.

Texas Answers European Critics

"It will come as a surprise to many that Mexico's largest single item of import is petroleum and its products. Mexico . . . is one of the major oil-producing nations of the Western Hemisphere. Yet it was forced to draw on outside supplies to take care of consuming markets in border areas in Northern Mexico. That was because such markets are distant from Mexico's oil production zones.

"This illustrates again the fact that available oil transportation and refining facilities are often more determining than mere oil fields in themselves. Unfortunately, Britain and other European critics of Texas' oil conservation practices are woefully ignorant of the whole picture.

"In the near panic induced in Britain and on the Continent by the Suez



Peerless type TU Multi-Stage Pumps

PEERLESS PUMPS

GENERAL SPECIFICATIONS

HEADS	Up to 1600 Feet
CAPACITIES	Up to 3000 GPM
TEMPERATURES	Up to 300°F
CASE PRESSURES	Up to 800 Lbs.
HP RANGE	Up to 325 BHP
DRIVES	All Types
CONSTRUCTION	Cast Iron, Bronze, Stainless

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION

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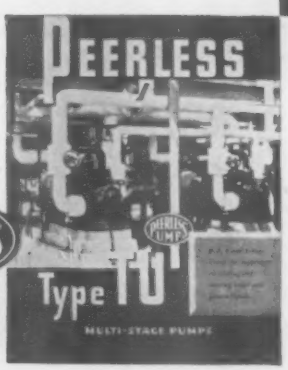
Distributors in Principal Cities; Consult your Telephone Directory

PEERLESS PUMPS fmc

4 COST-SAVING FEATURES OF THE TYPE TU LINE

- *SIMPLICITY IN DESIGN*
- *GOOD HYDRAULIC CHARACTERISTICS*
- *DURABLE, RUGGED CONSTRUCTION*
- *ON-THE-JOB DEPENDABILITY*



2, 3, 4 AND 5-STAGE PUMPS FOR SUPPLYING CIRCULATING AND BOOSTING WATER AND PROCESS LIQUIDS AGAINST MEDIUM AND HIGH HEADS. Put these dependable pumps to work for you. They'll deliver high maintained efficiencies over an extended service life. Their split-case design makes them easy to service and maintain. Their precision construction guarantees year after year durability. In all sizes 4" and under, cross over between stages is built integral with upper pump case. Over-size shafts, wear rings, shaft sleeves, heavy duty ball bearings, modern case and impeller design are outstanding features. Choose from many types and sizes for all head and capacity requirements.

PROFUSELY ILLUSTRATED BULLETIN. A new 4-color bulletin describes the Peerless Type TU pumps. It's complete with pump cross-section, dimensional drawings and load-capacity data. Use coupon below.

MAIL COUPON FOR NEW BULLETIN

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Please send a copy of TU Pump Bulletin No. B-1400 to:

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crisis shut-down of their oil flow . . . critics imagine that the Texas Railroad Commission can cure their plight overnight. They demand that controls on Texas wells be turned wide open to let oil spout unlimited and unrefined. You could drown Texas in a sea of surface oil, yet only a fraction of it could reach Europe in the emergency."

Editorial in Dallas Morning News.

Intemperate Hue and Cry

". . . It is difficult to understand the rash of intemperate public statements and proposed congressional investigations evoked by the recent modest and wholly inadequate increase in the price of petroleum and some of its derivatives.

"It cannot be interpreted in any other light than as part of a pattern which has made oil the favorite whipping boy in Washington. This conclusion is forced upon me as I realize that there has been no similar hue and cry as other major industries have, in the last 10 years, advanced the prices of their products with methodical precision and regularity."

Walter S. Hallanan, president, Plymouth Oil Co. and the National Petroleum Council, in a letter to Sen. Joseph C. O'Mahoney (D-Wyo.).

Inflation and Abundance

"Economists tell us that one of the best hedges against inflation is production. This is exactly the target at which the American petroleum industry is aimed. This industry will accept the responsibility for providing an abundant supply of oil, but it cannot operate outside the economic tides affecting the whole economy.

"We believe that the American consumer's topmost interest is in having oil and gasoline. He does not want scarcity at an artificial or fictitious price. In spite of the serious interruptions brought about by the Middle East crisis, there is an abundant supply of fuel oil and gasoline for the American consumer. That it should cost more should not be a great surprise, any more than should it be a surprise that everyone wants to pass the buck of responsibility to someone else."

Jake L. Hamon, American Petroleum Institute chairman of the board, in a speech before Independent Oil Men's Association of New England.

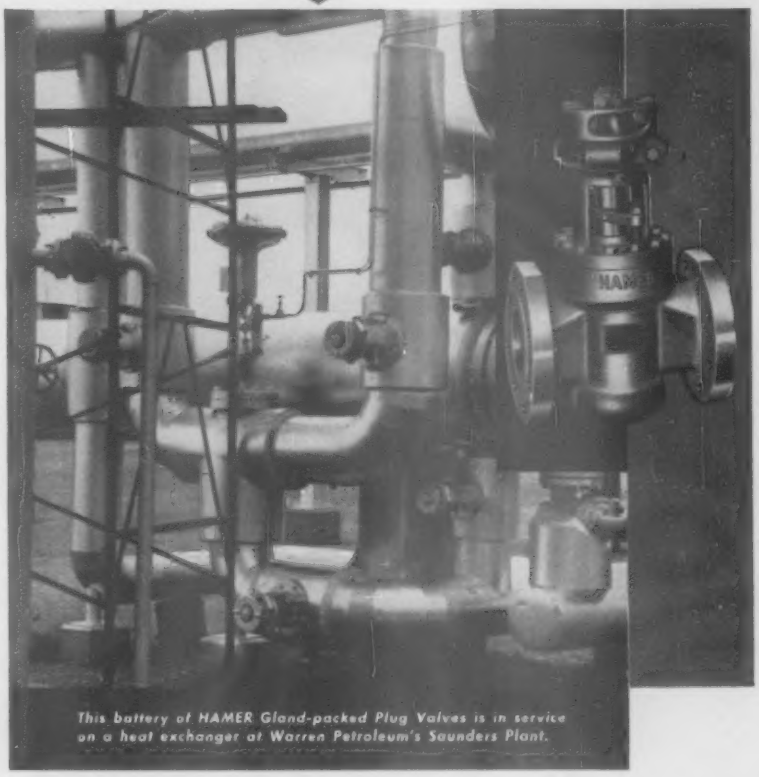
Praise for a Wise Policy

"Two things grew with America's oil industry—one was the system of prorating production to market demand for oil, leaving a 'shut-in' capacity for emergency use. The other was a wise tax policy which allowed for depletion

You can repack "LIFT-TYPE"

HAMER G. P. PLUG VALVES

under full operating conditions



This battery of HAMER Gland-packed Plug Valves is in service on a heat exchanger at Warren Petroleum's Saunders Plant.

HAMER *Line Blind Valves*

Built for strength and durability, Hamer Line Blind Valves are the modern means of blinding pipe lines quickly and effectively. A one-man, one-minute operation. Cuts costs, and speeds up operations.

Shutting down to change valve packings costs dearly in time and money. That's why Warren Petroleum uses Hamer gland-packed Plug Valves. Not only can Hamer gland-packed plug valves be repacked under full operating conditions, but because of the exclusive plug adjusting nut, a feature of all Hamer Plug Valves, the valves can't stick or freeze. No matter what the time lapse or service you have positive E-Z turn control at all times.

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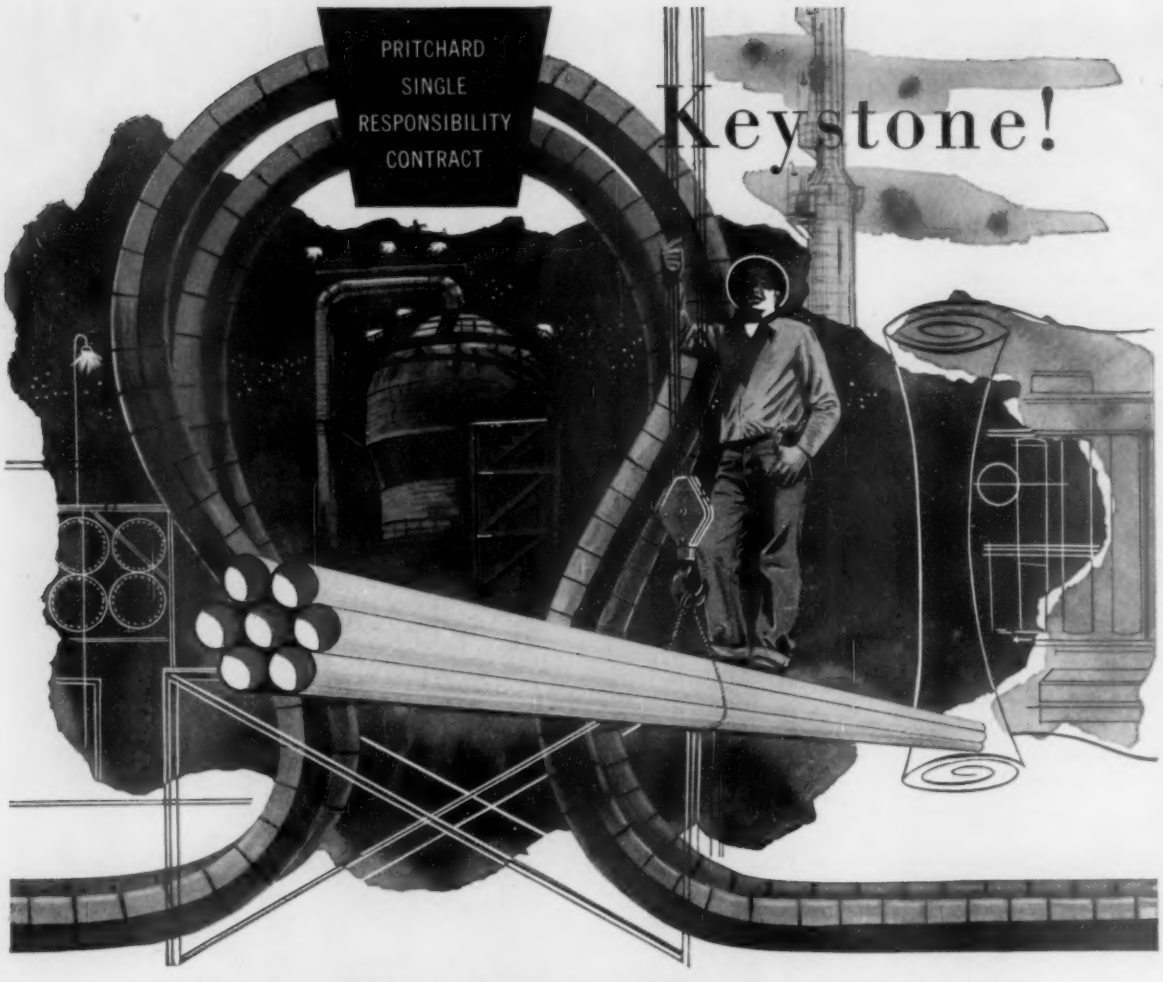
Representatives throughout the World



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You will find, as have many other companies in the petroleum and gas industries, that a Pritchard Single Responsibility Contract is the Keystone to a successfully completed construction, modernization or expansion project. And such a contract can be much more profitable to your company by saving time and money. Here's how.

PRITCHARD SAVES YOU TIME by carefully coordinating the entire project from initial planning to final testing. Work begins on your plant before engineering drawings are completed and there is a continuous, rapid flow of activity.

PRITCHARD SAVES YOU MONEY... earlier completion means earlier production, thereby producing income sooner. This also enables you to save interest and free invested funds sooner for other uses.

PRITCHARD GUARANTEES PERFORMANCE... good engineering is the basic attribute of a successfully completed contract. From Pritchard you get unmatched engineering service without paying a premium price. Performance of every project is guaranteed.

You are invited to consult with Pritchard on your next oil field, refinery or natural gas project.

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OF COOLING TOWERS AND GAS AND AIR TREATING EQUIPMENT

of oil in a well or a field and permitted further exploration so that the supply might be constant.

"In a nation like ours where the stuff pumped from the Gulf states and Oklahoma is as vital to the economy as a labor force, it was an evolvment of policy which speaks well for the sense of responsibility of the free enterprises involved—for greed could logically have been the paramount consideration, rather than conservation.

"As it is, America has a standby supply of oil—an emergency reserve—whenever it is needed. If there should be a shooting war, it's likely that as much as 2,000,000 bbl. of oil a day could be added to the usual production. And that could make the difference between victory and defeat."

Donald I. Rogers, New York Herald Tribune business and financial editor, in his column, Wall Street, U.S.A.

CALENDAR

FEBRUARY

21-22 Chemical Institute of Canada, eleventh division conference, protective coatings division, Seaway Hotel, Toronto, February 21, and Ritz Carlton Hotel, Montreal, February 22.

22 Natural Gasoline Association of America, Permian basin regional meeting, Scharbauer Hotel, Midland, Tex.

24-28 American Institute of Mining, Metallurgical and Petroleum Engineers, annual meeting, Hotels Roosevelt and Jung, New Orleans.

25-27 American Association of Petroleum Geologists, Rocky Mountain section, Rainbow Randevu, Salt Lake City.

27-28 Gas Conditioning Institute, sponsored by the University of Kansas extension, Southwest Kansas Center, Randall's, Liberal, Kans.

MARCH

1 American Institute of Chemical Engineers, Sabine area section, and American Chemical Society, Texas-Louisiana Gulf section, fourth annual joint technical meeting, Lamar College of Technology, Beaumont, Tex.

3-6 American Institute of Chemical Engineers, regional meeting, the Greenbrier, White Sulphur Springs, W. Va.

6-8 American Petroleum Institute, southwestern district production division meeting, Statler-Hilton Hotel, Dallas.

8 Ohio Oil and Gas Association, winter meeting, Deshler-Hilton Hotel, Columbus, Ohio.

11-15 1957 Nuclear Congress, sponsored by National Industrial Conference Board and Engineers Joint Council, Convention Hall, Philadelphia.

11-15 American Institute of Chemical Engineers, regional meeting, Philadelphia.

11-15 National Association of Corrosion Engineers, Kiel Auditorium, St. Louis.

11-21 Quality Control by Statistical Methods, tenth annual short course, sponsored by University of Illinois, College of Engineering and Division of Engineering Extension, Champaign, Ill.

12-13 Subsurface Geology Symposium, fifth annual conference, sponsored by the University of Oklahoma, Norman, Okla.

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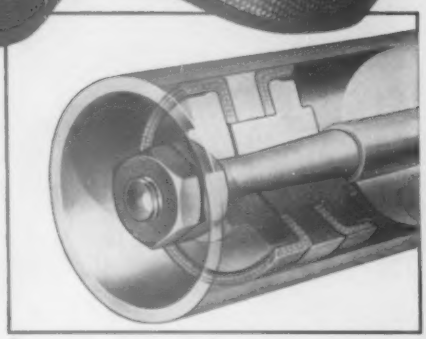
now yours for

- **HYDRAULIC CONTROLS**
- **AIR CYLINDERS**
- **RECIPROCATING PUMPS**

Two common Pumcup types: conventional and 45° bevel type . . . available in a complete range of sizes and texture-engineered compositions.



Cutaway view of typical Pumcup installation resulting in prolonged high efficiency.

TAKE it from experienced users, Darcova Pumcups offer payoff advantages that can't be equalled! For example, they last many times as long as ordinary piston packing..and they *hold peak efficiency* from start to finish. Because of the resulting production and maintenance economies, plant after plant is standardizing on Pumcups.

Improved application of the cup principle does the trick. And Darcova Pumcups are *texture-engineered* in *a range of compositions* to meet most temperature-pressure-fluid conditions. And they are available in sizes and types exactly right for your particular equipment.

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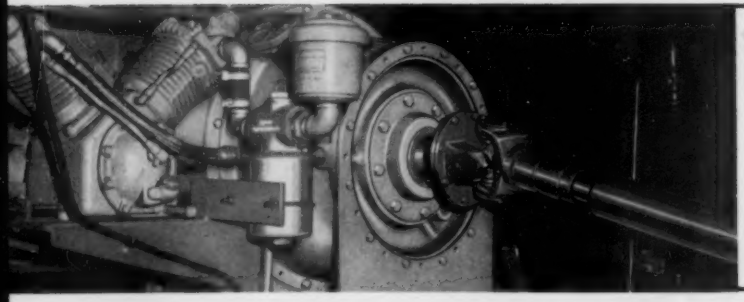
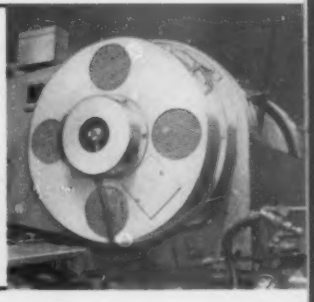


Transmission

An Allison Torqmatic Transmission provides 3 speeds forward and reverse to vehicle and also to hoisting drums.

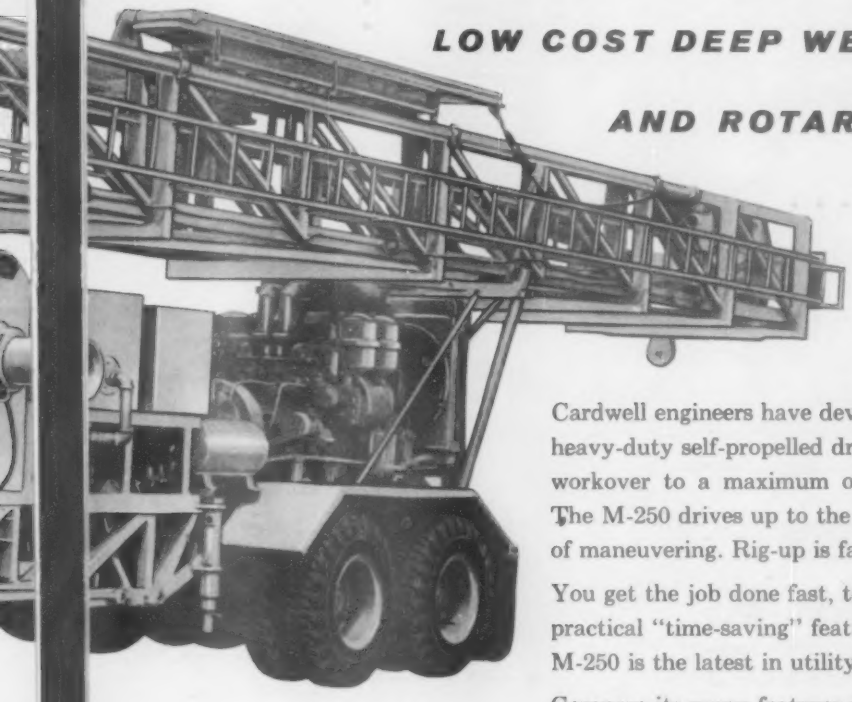
Friction clutches

All friction clutches are air actuated. Outboard mounting provides easy accessibility when servicing is required.



on this New M-250 Rig!

DESIGNED SPECIFICALLY FOR LOW COST DEEP WELL SERVICING AND ROTARY WORKOVER!



Cardwell engineers have developed this truly versatile heavy-duty self-propelled drive-in rig for servicing and workover to a maximum of 13,000-feet, with 2½" tubing. The M-250 drives up to the well head and with a minimum of maneuvering. Rig-up is fast for servicing operations.

You get the job done fast, too . . . because it has all the practical "time-saving" features needed on a rig. Cardwell's M-250 is the latest in utility and performance.

Compare its many features with any competitive rig . . . then you'll know why Cardwell's M-250 is the best dollar buy you can make!

Features

- **HEAVY DUTY MAST**—4-leg free standing structural type, 96' high, 150,000 pound rated hook load capacity. Hydraulic power is used to raise and extend the mast.
- **HIGH CAPACITY HYDRAULIC PUMP**—for mast erection and operation of power tongs is standard equipment. Additional pump available for hydraulically powered rotary table or power swivel.
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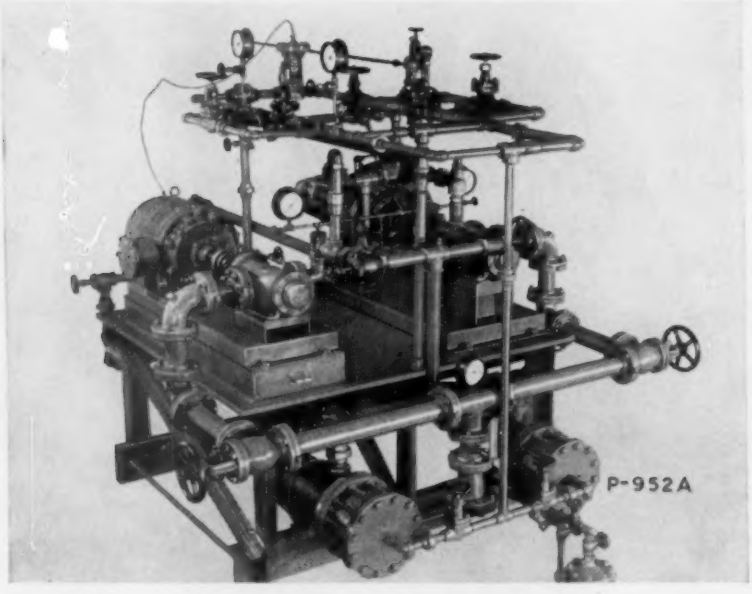

P-952A—Steam Turbine and Electric Motor drive gives flexibility in this compact Model P-ES2H size No. 25 unit.

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13-15 Society of Exploration Geophysicists, tenth annual mid-western meeting, Hotel Texas, Fort Worth.
18-21 American Society of Mechanical Engineers, national conference, gas-turbine power division, Sheraton - Cadillac Hotel, Detroit.
20-22 American Petroleum Institute, southern district production division meeting, Washington - Youree and Captain Shreve Hotels, Shreveport, La.
25-27 Western Petroleum Refiners Association, annual meeting, Hilton Plaza Hotel, San Antonio, Tex.
25-29 American Society for Metals, Western Metal Exposition and Congress, Ambassador Hotel and Pan-Pacific Auditorium, Los Angeles.
27-29 American Power Conference, Sherman Hotel, Chicago.

APRIL

1-4 American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, national convention, Kiel Auditorium, St. Louis.
2-4 Corrosion Control, fourth annual conference, sponsored by National Association of Corrosion Engineers and the University of Oklahoma College of Engineering, University of Oklahoma, Norman, Okla.
7-10 Petroleum Equipment Suppliers Association, annual convention, Palm Springs, Calif.
7-12 American Chemical Society, national meeting, Miami, Fla.
8-10 American Society of Mechanical Engineers, spring meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala.
9-11 American Welding Society, fifth annual welding show, Convention Hall, Philadelphia.
10-12 American Petroleum Institute, Mid-Continent district production division meeting, Mayo Hotel, Tulsa.
11-12 West Texas Oil Lifting Short Course, Texas Technological College, Lubbock, Tex.
11-13 Institute of Radio Engineers, ninth annual southwestern I.R.E. conference and electronics show, sponsored by Houston section, Shamrock Hilton, Houston.
11-13 Institute of Radio Engineers, second national simulation conference, sponsored by Professional Group on Electronic Computers, Shamrock Hilton Hotel, Houston.
11-13 American Institute of Mining, Metallurgical, and Petroleum Engineers, Pacific Northwest Regional Conference, Portland, Ore.
16-18 Petroleum Industry Electrical Association annual meeting, Shamrock Hilton Hotel, Houston.
16-18 Petroleum Electric Suppliers Association, Shamrock Hilton Hotel, Houston.
16-18 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, Okla.
16-18 National Petroleum Association, fifty-fourth semiannual meeting, Cleveland.
18-19 Texas Petroleum Research Committee and Permian Basin Section of American Institute of Mining, Metallurgical, and Petroleum Engineers, tenth annual oil-recovery conference, Midland, Tex.
22-25 Canadian Institute of Mining and Metallurgy, annual general meeting, Chateau Laurier, Ottawa.
24-26 National Gasoline Association of America, thirty-sixth annual convention, Rice Hotel, Houston.
24-26 American Petroleum Institute, Rocky Mountain district production division

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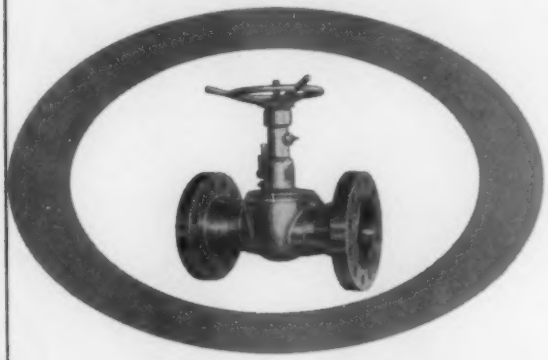
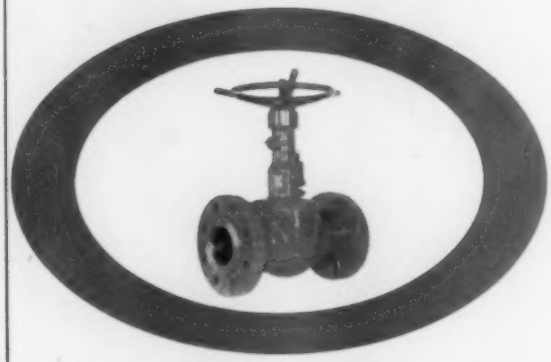


ORBIT



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meeting, Gladstone, Townsend, and Henning Hotels, Casper, Wyo.

25-27 American Association of Petroleum Landmen, third annual convention, Hilton Hotel, San Antonio, Tex.

28-30 Independent Petroleum Association of America, midyear meeting, Buena Vista Hotel, Biloxi, Miss.

29-30 Automatic Control in the Petroleum and Chemical Industries, conference sponsored by the University of Oklahoma, extension study center, University of Oklahoma, Norman, Okla.

29-May 1 Southern Gas Association, annual convention, New Orleans.

MAY

1-3 American Petroleum Institute, Division of Production, eastern district meeting, William Penn Hotel, Pittsburgh.

6-8 American Petroleum Institute, annual pipeline conference, Cleveland Hotel, Cleveland.

6-8 American Geophysical Union, thirty-eighth annual meeting, National Academy of Sciences, Washington, D. C.

7 American Gas Association, committee on underground storage, operating section, Mark Hopkins Hotel, San Francisco.

8-10 American Gas Association, Pacific Coast Gas Association, gas supply, transmission, and storage conference, Mark Hopkins Hotel, San Francisco.

12-15 Liquefied Petroleum Gas Association, annual meeting, Conrad Hilton Hotel, Chicago.

13-15 Industrial Waste Conference, sponsored by Purdue University, Purdue Memorial Union Building, Lafayette, Ind.

13-16 American Petroleum Institute, division of refining, midyear meeting, Sheraton Hotel, Philadelphia.

14-16 Industrial Nuclear Technology Conference, sponsored by Armour Research Foundation of Illinois Institute of Technology and Nucleonics Magazine, Museum of Science and Industry, Chicago.

16-17 American Petroleum Institute, division of production, Pacific Coast district meeting, Hotel Biltmore, Los Angeles.

19-22 Texas Independent Producers and Royalty Owners Association, Galvez and Buccaneer Hotel, Galveston, Tex.

20-22 American Petroleum Institute, division of transportation, central committee on transportation by water and tanker corrosion symposium, San Francisco.

20-22 American Gas Association, chemical, engineering, and manufactured gas production conference, Balmoral Hotel, Bal Harbour, Fla.

20-23 American Society of Mechanical Engineers, twenty-ninth annual conference and exhibit of the oil and gas power division, Kentucky Hotel, Louisville, Ky.

21-23 Pennsylvania Gas Association, annual meeting, Pocono Manor Inn, Pocono Manor, Pa.

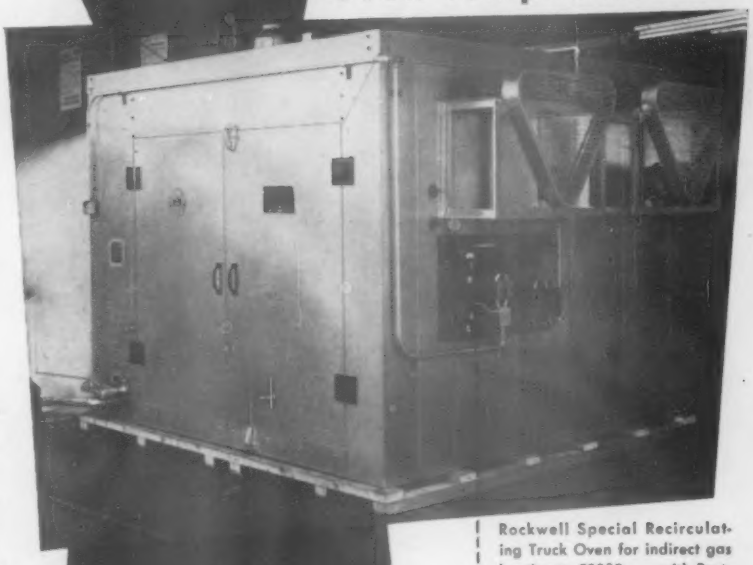
23-24 Kentucky Oil and Gas Association, annual membership meeting, Hotel Phoenix, Lexington, Ky.

23-24 American Institute of Mining, Metallurgical, and Petroleum Engineers, third annual joint meeting, Rocky Mountain petroleum sections, Northern Hotel, Billings, Mont.

23-24 Western Petroleum Refiners Association, southwest regional technical-industrial relations meeting, Hotel Paso del Norte, El Paso, Tex.

29-31 Annual short course in gas technology, Texas College of Arts and Industries, Kingsville, Tex.

w. s. rockwell company depends on partlow controls for accurate oven temperatures



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Rockwell Standard Bench Oven with Partlow M2 Electric Indicating Control . . . range 50° to 350°F.

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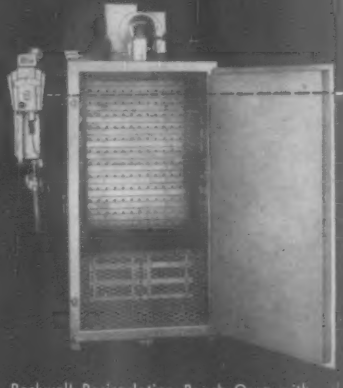

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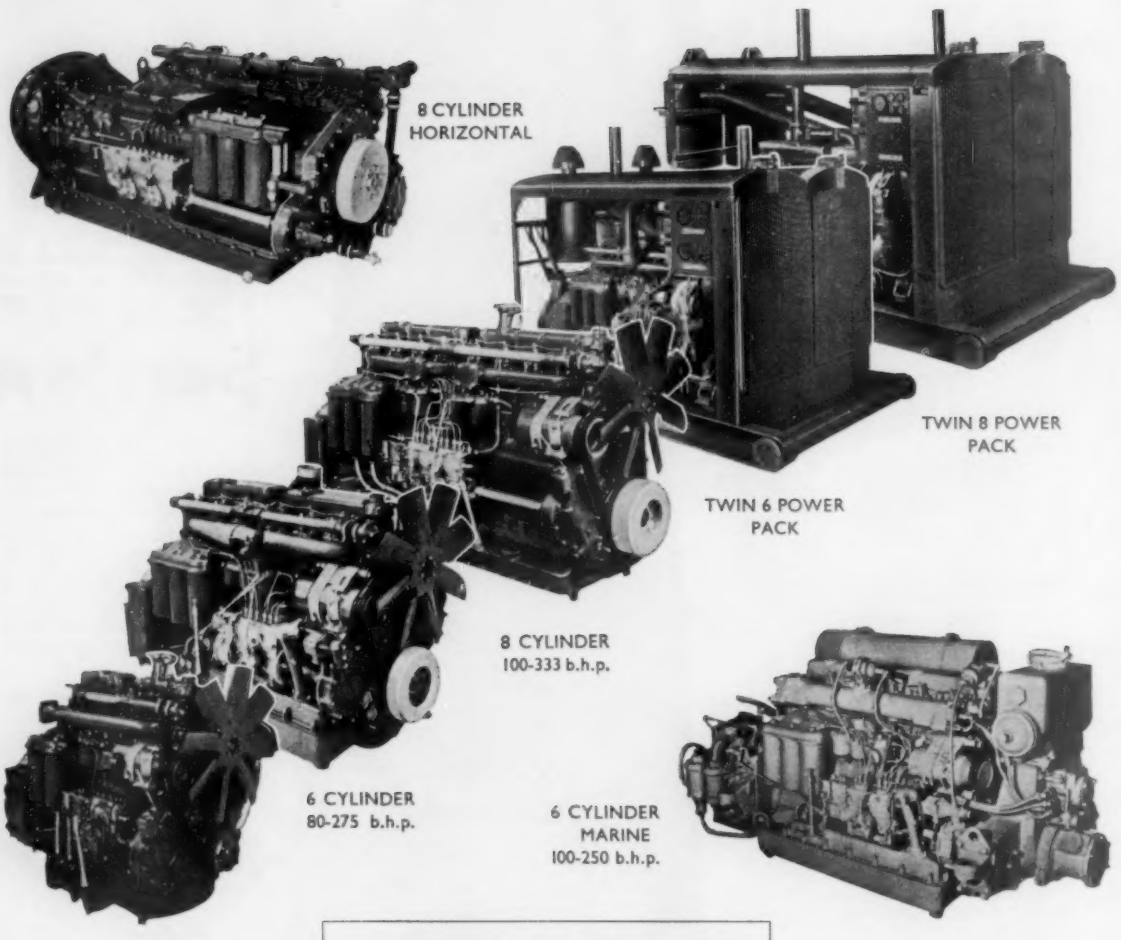

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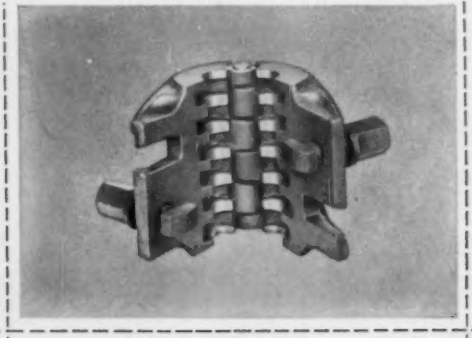

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TULSA, OKLAHOMA

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JOURNALLY SPEAKING . . .

The Thinking Machine

"AUTOMATION?" said the Professor. "Automation is a much-abused word—if it is a word.

"You see it constantly these days, but much of the time it's applied to things it ought not to mean. People are always getting it confused with instrumentation, remote control, electronic computing, and cybernetics.

"Why, even your own Oil and Gas Journal is a bit fuzzy in its use of the term. For example, just look at the special section on pages 121 to 136 of the February 18 issue. It purports to discuss 'process automation' but concludes that there is no such thing.

"At least there's no such thing according to my understanding of the term. The word 'automation' is so new that it isn't in the dictionary. So I suppose it can mean whatever a user wants it to mean.

"But to me it's a contraction of 'automatization.' This means making an automaton of something. And an automaton is something that moves or acts under its own power but without intelligence. I'm glad to see the word shortened but I don't like to see its meaning broadened."

"What do you mean by that, Professor?"

"Why, today 'automation' has come to mean practically a thinking machine—which is just the opposite of what I think it ought to mean—the opposite of its root meaning.

"I think of automation as a machine, or possibly a whole factory, that operates by itself on a set pattern without human manipulation or even without human guidance after the initial setting. It's a slave, or a robot."

"Well, how about remote controls?"

"A control is a control, whether it's remote or immediate. It's just putting a longer handle on your knob or lever. But electronic, pneumatic, or other devices which permit an operator to manipulate his machine at a distance aren't automation."

"Then what's instrumentation?"

"Nothing more or less than adding instruments to tell speed, pressure, temperature, and so on. Today we have remote-reading instruments, self-recording instruments, and automatic loggers that do a certain amount of analysis and computation of their data.

"If these instruments were hooked up to a feedback—connected to remote controls so that the machine or plant would be kept operating on a set pattern without human intervention—then you would have true and complete automation, to my way of thinking. But it still would be short of what some people consider automation."

"That other word you used—cybernetics? Would that be a thinking machine?"

"Closer to it, but not quite. Cybernetics comes from a Greek word meaning 'steersman,' and it's a study of control systems—either of the human body or of a mechanical contrivance. The word is used a lot these days in connection with electronic computers—which, by the way are only glorified adding machines. They do a lot of work in a hurry, but they're true automatons, not thinking machines."

"Well, Professor, would it be possible to combine cybernetics and all these other things and get a refinery that really runs itself?"

"Maybe, son, but that's quite a piece down the road.

"First you would need a stream analyzer on the crude line to tell what kind of raw material is coming into the plant. This would feed into a computer set up to determine the product yield pattern—on the basis of price and market data previously put into its memory unit.

"It's possible that the computer could relay its determinations to automatic remote controls which would activate the proper valves and pumps and set the right pressures and temperatures. Then feedback instrumentation would keep the plant on the beam until the computer gives a new set of instructions.

"Then we would have complete process automation in the sense that most people use that term—meaning a completely 'self-thinking' plant that doesn't need anybody around after some human has given it its instructions and pushed the starting button.

"But we don't have true process automation like that today."

"Thank you, Professor."

—Henry D. Ralph.

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Latest addition to famous Transet line uses unique Motion-Balance principle. Proven by months of tests on toughest applications.

HERE'S the first in a series of new Taylor TRANSCOPE instruments that will set new standards of process control performance. It's the new TRANSCOPE Controller—a miniature controller that's new in design, new in principle . . . and in performance has no equal, particularly on applications where the span of measurement is very short. It is ideal for the time constants of modern processing.

Simple to adjust, easy to maintain—and to convert from one form of control to another, the TRANSCOPE Controller can be panel, rack or field mounted. The adjustable proportional response system is based on the Motion-Balance principle that uses bellows as pressure sensitive elements. The illustration on the opposite page shows how the instrument looks—here's what it means in your plant:

1. Exceptionally fast and smooth response—particularly important on start-ups.

2. Ease of alignment—smooth-acting screw-driver adjustment because of ball-bearing construction.

3. New high standard of accuracy and setting for gain, reset and Pre-Act responses.

4. Outstanding in its insensitivity to ambient temperatures.

5. Very low air consumption—only 0.1 scfm.

6. Adaptability to changes in process requirements . . . complete interchangeability of components so you can convert from simplest to most complex forms of control *in the field.*

7. Instrument action is reversed by merely rotating a dial.

8. Integral cut-off relay—a *built-in feature*—for field-mounted or panel-mounted use.

9. Plugs into Transet Indicators or Recorders or locally-mounted manifolds.

10. Friction-free bending member . . . no maintenance because no wear.

11. Easy access to nozzle and baffle.

12. Rugged bellows construction keyed in position. Dynamically-balanced force plate.

13. Stainless steel nozzle and baffle . . . hardened stainless reaction members . . . rugged aluminum assemblies. Dust and moisture-proof case suitable for outdoor mounting.

Write for Bulletin 98278.

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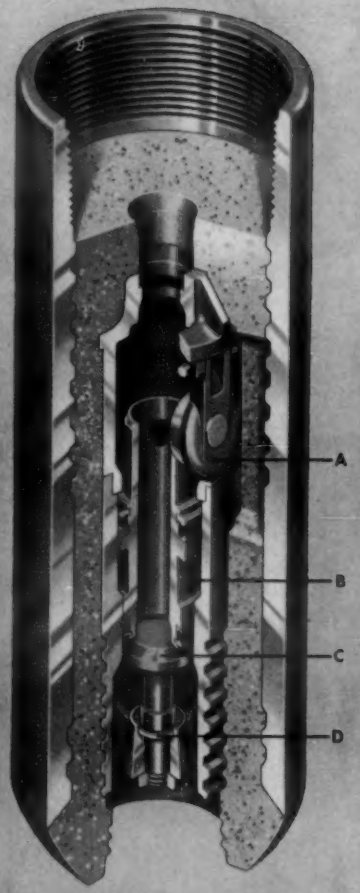


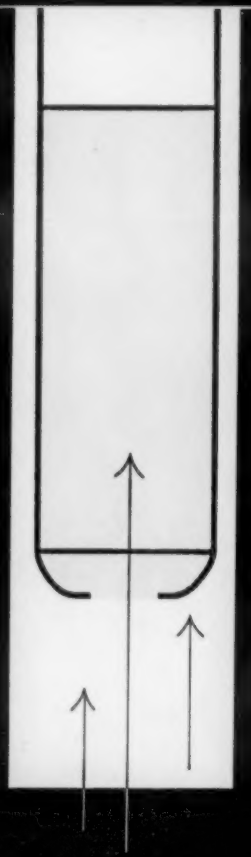
A Flapper Type Back-Pressure Valve activated at option of operator.

B Sleeve Valve } Control rate of flow and volume of fill-up fluid.

C Sleeve Valve Seat }

D When operator shears this Shear Ring (1,000 psi in casing), Flapper Valve is released to form a Back-Pressure Valve for floating or cementing.

Baker DIFFERENTIAL FILL-UP Shoe
Product No. 1081

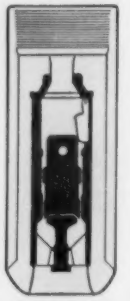


It fills casing from the bottom up

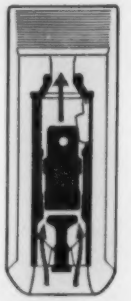
With Baker DIFFERENTIAL FILL-UP Shoes and Collars, casing is filled automatically from the bottom up, *while it is being run*... and because DIFFERENTIAL Equipment contains a Variable Valve *that opens and closes* to synchronize the rate of "fill" with the rate of lowering the casing, maximum reduction of destructive high-pressure surges is obtained.

This "controlled automatic fill" saves up to one-third of running-in time because... (a) time-wasting surface filling of casing is eliminated; and (b) casing can be run in at a faster speed, reducing the possibility of sticking, without causing destructive high-pressure surges. Pressure surges over 5000 psi can be created below casing equipped with floating equipment each time a joint is lowered. Damage caused by these high-pressure surges and the cost of this damage in bad cement jobs, lost circulation, and decreased production is becoming a matter of concern to many operators.

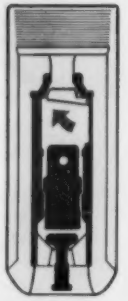
HOW DIFFERENTIAL EQUIPMENT WORKS



RUNNING-IN
Sleeve Valve in closed position



RUNNING-IN
Sleeve Valve in opened position



CEMENTING OR FLOATING
Flapper Valve released

Hydrostatic pressure of the "fill" acts on the upper pressure area of the sleeve valve. Hydrostatic pressure of the fluid in the annulus acts on the lower pressure area of the valve which is 90% of the upper pressure area. It is this differential in area that results in a "fill" of approximately 90% (shoe or collar), or 81% (shoe and collar) with respect to the fluid level of the annulus and gives the equipment its name. The valve opens and closes in accordance with the pressure differential across it to: (1) fill the casing automatically, (2) reduce pressure surges and (3) prevent overfill of the casing.

BAKER OIL TOOLS, INC.
HOUSTON • LOS ANGELES • NEW YORK

BAKER DIFFERENTIAL Fill-Up Equipment

Not justice but a Roman holiday

THE case of the public v. oil is now before the bar. The charge: Higher prices. The defendant has been prosecuted by the press, castigated by Congress, and haled before a federal grand jury.

It's a strange case. The crime is inflation. But the defendant now on trial is the victim, not the perpetrator, of the crime.

While prices of everything but crude oil moved upward the public did little more than shake its head resignedly. Now when oil belatedly tries to catch up with the parade it is clobbered with charges of robbery, gouging, and conspiracy.

THE CASE FOR THE DEFENDANT is sound. Under our economic system a producer of anything is entitled to raise prices as his costs increase, to the extent that competition in the market place permits.

Oil has had a double cost squeeze. New reserves are harder to find, requiring more difficult exploration and deeper drilling. This has been at least partially offset by measures within the control of the industry, such as increased efficiency and productivity.

But the biggest squeeze is general inflation. Wages, steel, and all other elements of cost have been climbing steadily while crude prices remained static. This is entirely beyond the control of oil men, the fault of the nation as a whole.

Crude prices didn't rise earlier because of competition. Oversupply created a buyers' market, giving producers no choice but to take what they were offered or close up shop. But as soon as imports went down and demand went up, this obstacle vanished. Only then could prices follow costs upward.

Higher prices traditionally bring out more supplies. In the case of oil, this process may take a little time. But there is ample evidence that a higher crude price is necessary to develop new reserves and that this increase will have that result.

There is adequate economic justification for the price rise. Unfortunately, however, the case against oil is political, not economic. Its prosecutors want not justice but a Roman holiday.

OIL'S MISHAP was its timing. It was a year or so late in moving to make its prices cover its costs. Other industries have been doing this unscathed. Now general concern over inflation singles out oil to take the punishment for all.

Oil had the misfortune to raise prices the week that inflation became a major topic in Washington. It was also the week that Europe screamed that it was not getting enough oil. There may be no "best time" to raise prices from the standpoint of public opinion. It was oil's bad luck that its increase happened at the worst possible time.

Right in the middle . . . and proud of it!

Anchor is proud of the service they render. And many, many refinery and natural gasoline plant operators are happy that Anchor does so. Here's why: *Anchor relieves you refinery experts of all the sales, traffic and accounting duties attendant on the marketing of your products.* This eliminates some of your work, worry and expense. Anchor has made an important place in the industry by providing the most of the best in nation-wide transportation, storage and personnel. Also, Anchor folks have a real interest in being the best. So call them, Tulsa, CHerry 2-7261.

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The Industry This Week

• **INDUSTRY:** Oil prices are still too low. Even after increases they lag behind prices of items that influence their cost, a Journal special study shows. P. 100.

Europe is getting more oil than promised, Interior Secretary Seaton tells O'Mahoney committee. It's the high spot in hectic week in Washington for oil. P. 102.

Jersey Standard's Rathbone defends industry's oil lift plan in unusual news conference. Jersey alone is furnishing nearly half of the goal. P. 104.

Prices on oil-country steel items are up again—this time from 3.5 to 4 per cent. It'll cost the oil industry more than $40 million this year. P. 106.

• **PIPELINING:** French companies exploring in the Sahara Desert of Algeria are considering a crude line. Transport will be a big headache if two promising discoveries in remote areas prove to be big fields. P. 118.

Pipe to carry natural gas from Mexico to U. S. markets is snaking across Texas' historic San Jacinto Battleground area. That's where Texans won their independence from Mexico. P. 108.

• **PRODUCTION:** Texaco is ready to put its big Cogdell field water flood into full swing. It will increase number of injection wells to 32 and injection fluid to 50,000 bbl. daily. Goal is 60 million more barrels of production from 15,000 acres. P. 114.

Government warns oil industry that pollution of interstate waters must stop. Warning came in specific notice to group in Arkansas. P. 115.

Outlook in West Germany is for continued rise in oil production for next 4 years. Output is expected to reach 80,300 bbl. daily. P. 119.

Calco is challenging Colorado gross production tax in Denver court fight. At stake is $10 million. P. 111.

• **DRILLING:** Mid-Continent operators have stepped up use of drilling-mud cyclone centrifuges. They report savings in time and money. P. 117.

Flurry of deep drilling looms for East Texas. The excitement is stirred by Texaco discovery near Corsicana in midst of shallow production. P. 114.

Apco's offshore well that was held up so long by a boundary dispute is dry. P. 106. . . . But Gulf has a new offshore field south of its Timbalier Bay field. Production is from two deep zones. P. 113.

• **REFINING:** British Petroleum is moving into North America with an integrated operation. Plans call for a 30,000-bbl. refinery at Montreal and distribution and marketing facilities in Quebec. P. 107.

Humble is moving out front with hydrogen treating. Its new facilities will boost Hydrofining to 64 per cent of total crude capacity. P. 110.

Magnolia's formula for getting along with refinery unions: Prevent disputes from arising when possible. P. 112.

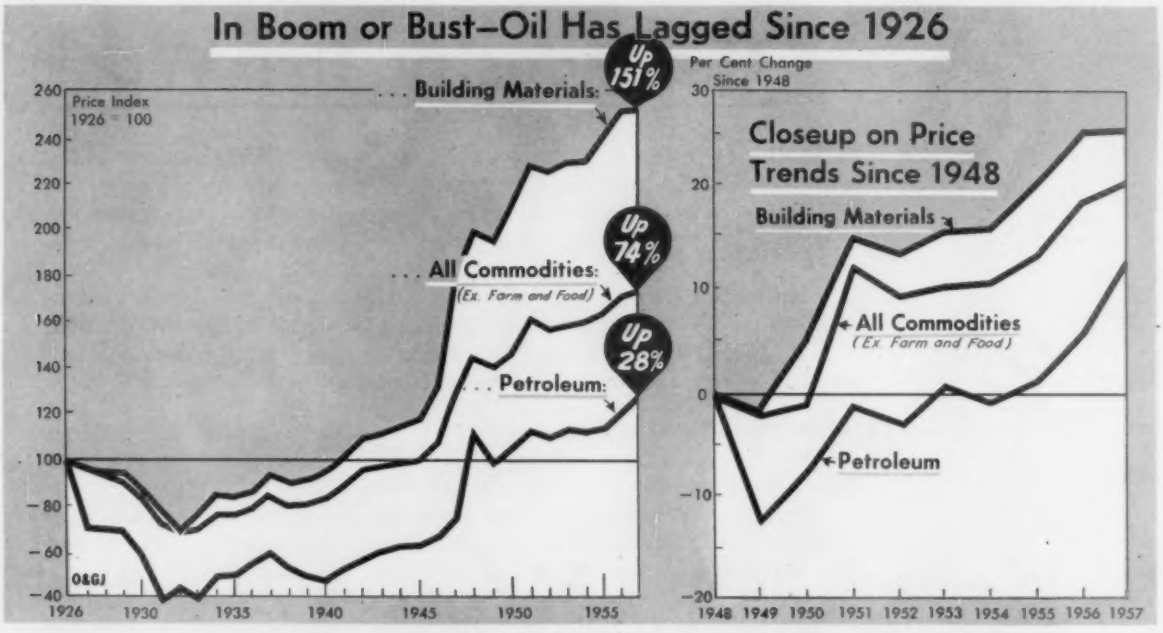
Refiners continue to speed up cutbacks and yield shifts to save oil for Europe. Some are shutting down early for turnarounds. P. 103.

• **EXPLORATION:** New field for fast gravity-meter interpretation may be opened by Seismograph Service's new optical analog gravity computer. Under new policy the instrument is for sale. P. 116.

California's tidelands operators are hard hit by the lease moratorium. They now fear high royalties will lead to state's taking over. P. 117.

Future natural-gas exploration hinges on higher gas prices, Phillips tells FPC as famous case reopens. Gas shortage will crop up in 10 years unless discoveries are increased. P. 109.

Kuwait has a new major field. Kuwait Oil Co. officials revealed first details of the field in London last week. P. 119.



Oil Prices Are Below Par for the Course

OIL prices are still low. The accompanying charts and the statistics on which they are based plainly show that.

Even after last month's advance, over-all prices of crude and most major products still lag behind the prices of items that influence their cost.

The average service-station price for gasoline is a prime example. After the January increase and excluding taxes, it was only 18.9 per cent above the mean for the base years 1947-49 (see front-cover chart).

But consider two of the most important cost items in making gasoline: Wages and crude. Refinery workers' wages went up 53.8 per cent since the 1947-49 period. East Texas crude was up a little less than 31 per cent. Oklahoma-Kansas crude of 36-36.9°-gravity showed a similar advance.

Actually the January average probably was lower than the one used to arrive at the 18.9 per cent gain. The basis for retail gasoline prices charted is the monthly survey of prices in 50 typical cities. Since the January average was not available, a flat 1 cent a gallon was added to the December average. But there were price-war areas where advances were less than 1 cent.

What about crude . . . The same story is true of crude prices.

Wages and steel are the most important cost items in discovering and producing oil. The new January postings for typical crudes represented gains of little more than 30 per cent over 1947-49.

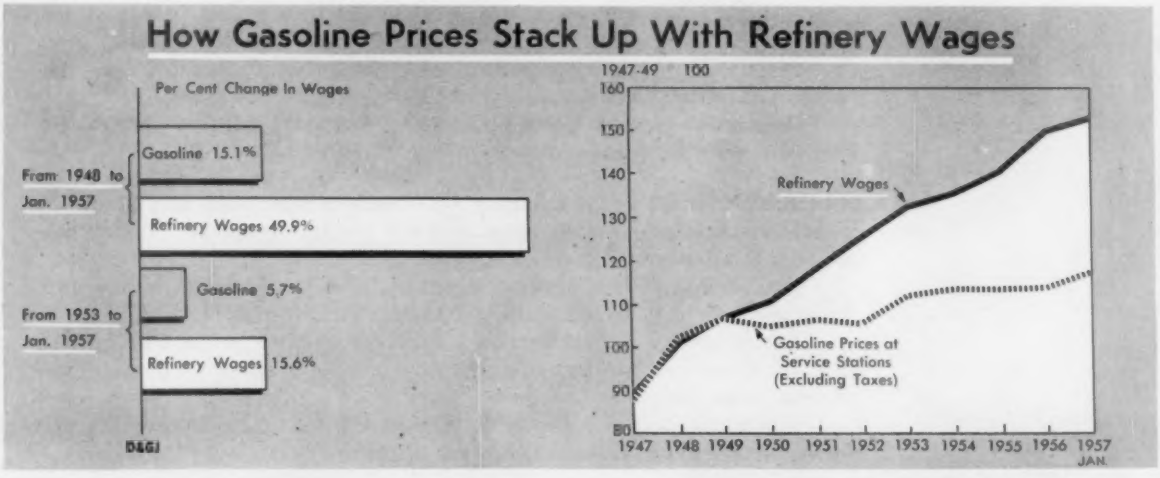
Compare this small increase with gains of:

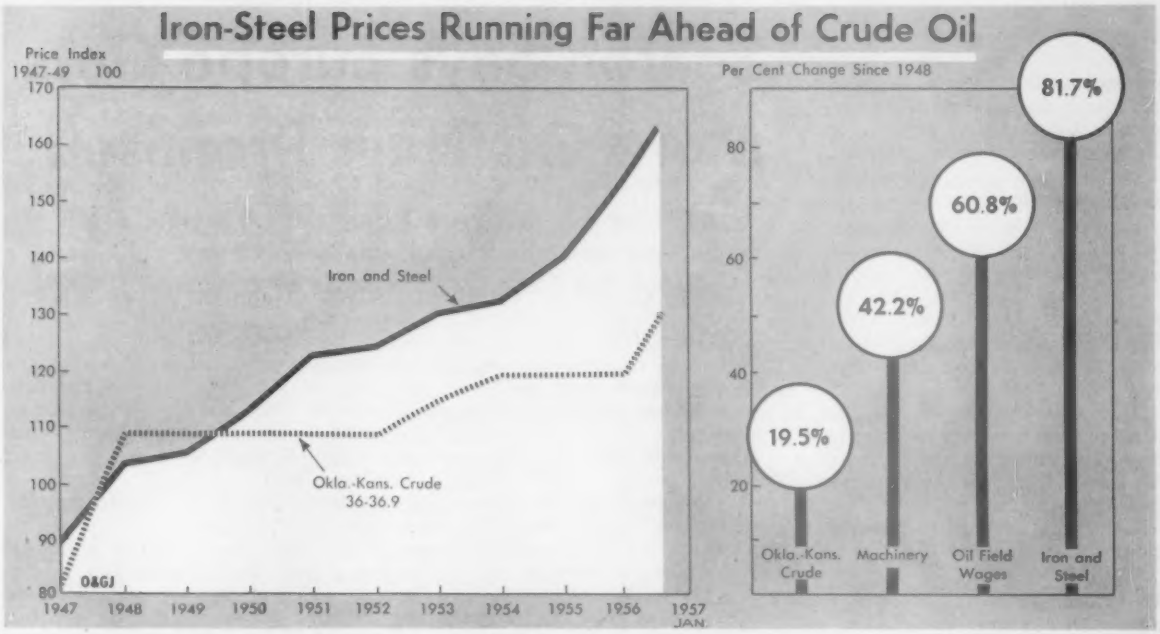
. . . 63.5 per cent for labor.

. . . 63.0 per cent for iron and steel.

Only one wage comparison was used in the cover chart because of space limitations. Refinery workers' wage gains were used because they also influenced costs of gasoline production. But the average hourly wage of oil and gas workers has moved up faster than pay of refinery workers.

Oil and gas workers have received pay gains of 63.5 per cent above the 1947-49 base. That was the case at the beginning of 1957. Bureau of Labor





Statistics report for January wages is not yet available. So the latest reported month in 1956 was used for comparison with crude and product prices.

The 63 per cent gain in steel prices since 1947-49 base period reflected the situation only through January. It does not include recently announced increases for most oil-country goods put into effect this month.

Steel companies have shown that the higher prices for their products are necessary because of increased costs. The charts indicate the oil industry has been laggard in moving to recover its increased costs through higher prices.

Why the indexes . . . Most of the charts showing oil's price position make use of index numbers to show comparisons. This is necessary because the comparisons are between unlike items.

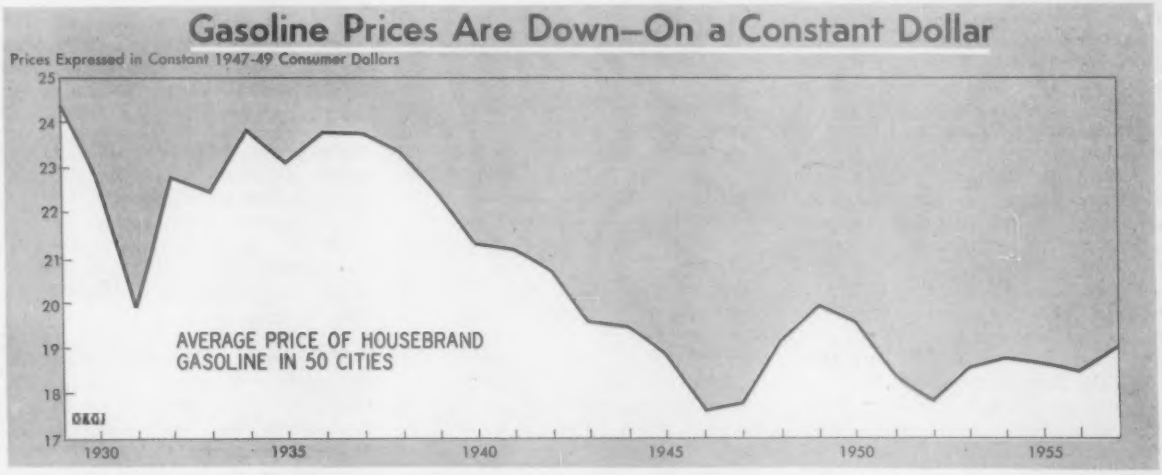
The index numbers indicate percentage change from a base year or period which is represented as 100. Percentage increases, thus, can be read from the charts by subtracting 100 from the index numbers. An index number of 150, for example, means a gain of 50 per cent from the base period.

The gasoline story . . . A more detailed study was made of comparisons of gasoline prices and refinery wages. The year-by-year changes since 1948 are shown in the charts as trend lines. Percentage gains over 1948 are represented as bars.

The year 1948 was the first full year following crude advances made necessary by inflation during and just after World War II. Gasoline prices at service stations, excluding taxes, gained only 15.1 per cent from 1948 to January 1957. Note that refinery wages jumped 49.9 per cent. The general trend for the intervening years is shown by the line chart. Percentage gains from the base period can be found by subtracting 100 from the index numbers.

An even more revealing chart shows the trend of gasoline price plotted in constant dollars. This shows the constant-dollar price of gasoline is about the same as it was in 1948.

Here's the explanation of how that is figured. The constant-dollar price for any year is the average price actually paid for house-brand gasoline at service stations divided by the consumer price index for that year. This index covers all commodities. When the plotted line shows a downward trend, one of two things is happening: Gasoline prices are not increasing as fast as all consumer commodities. Or gasoline is decreasing faster than all-item prices. Prices on the chart are ex-



pressed in average 1947-49 dollars.

Quality factor . . . Even if motorists are paying the same relative price for gasoline they paid in 1948, they actually are getting more for their money.

The vastly improved quality of the product is not shown on the charts.

Here's that story. The average regular gasoline in 1948 was about 80.2 octane, according to the winter and summer surveys for that year by the Bureau of Mines. The latest survey by Ethyl Corp. shows that regular gasoline marketed in January of this year averaged 90.5 octane.

Ten octane numbers in less than 9 years represents a huge increase in refinery investment and accounts for a big part of the 15 per cent increase in gasoline prices since 1948. Actually refiners are recovering less of their other inflated costs than the charts indicate.

The crude picture . . . More detailed comparisons between crude prices and cost items are shown by other charts.

The line chart compares gains for steel and crude prices for all years since 1947, using indexes based on 1947-49 as 100. The bar charts show percentage gains for Oklahoma-Kansas crude, machinery, oil-field wages, and steel since 1948. The gain for crude includes the January increase of 25 cents a barrel.

Another chart has been added to show the long-term trend in the relationship between petroleum prices and other items. The comparison here is with building materials and all wholesale commodities except farm and food. The base year of 1926 was one of the early bench marks for comparing prices, and it is the earliest year shown on current price-index tabulations. The January 1957 petroleum price index number was estimated from known increases in components that make up the Petroleum and Products group.

Note that petroleum and products prices showed less than 30 per cent gain between 1926 and 1957. All commodities, other than farm and food products, gained almost 74 per cent for the same period. The big gain was in building materials, up a little more than 150 per cent.

Trends for these same items since 1948 are just as revealing. Lines on the small accompanying chart are plotted as percentage changes each year from the 1948 base. They show these net gains through January 1957: Petroleum, 12.6 per cent; all commodities except farm and food, 20 per cent; and building material, 25.8 per cent.

All the charts and statistics, in effect, give a single picture: Petroleum industry costs are up. Product quality is up. But, prices are still low.

Seaton Says Europe Gets More Oil Than Promised

● Shipments will be 80 per cent of normal needs this quarter and oil-lift goal was only 75 per cent, top officials tell Congress in defense of program

WASHINGTON.—International controversy continued to center around the oil industry last week over the oil-for-Europe program and increased prices.

These were the fast-moving developments:

. . . Congressional committees remained the spring board for more attacks on the industry. Even a new investigation was ordered.

. . . Government officials testified Europe is getting more oil than was promised when Suez was closed.

. . . A special grand jury was called to look into oil's pricing system.

. . . Defenders of industry acts in the crisis moved to present their case to the public for the first time. Jersey Standard's M. J. Rathbone led off (see page 104).

. . . Steel prices for oil-country goods were raised quietly. The hikes average 3.5 to 4 per cent and will cost the industry at least $40 million annually (see page 106).

. . . Refiners stepped up plant cutbacks and yield shifts. Big processors started to shut down units for early repairs to make crude available for Europe quickly (see page 103).

Promise fulfilled . . . Interior Secretary Fred A. Seaton and Mobilization Director Arthur S. Flemming defended the oil program before a Senate committee late in the week.

Seaton said Western Europe will get 80 per cent of its oil needs this quarter. He gave the first dependable figures on Europe's situation that have become available since start of the oil lift.

They show the Organization for European Economic Cooperation estimates first quarter supplies of gasoline and diesel fuel will be 76 per cent of normal. Other estimates: fuel oil 79 per cent normal, motor gasoline 87 per cent. The over-all supply will be 80 per cent of normal.

Flemming told the committee this country never promised Europe more than 75 per cent of its requirements could be met. He warned, however, the problem isn't solved merely because Europe is getting within 20 per cent of the oil it needs. "There is more to be done," he said.

Both Seaton and Flemming declared the government-industry plan for the oil lift was the best that could be found. They said any alternative, particularly one requiring government participation, would have been slower and less effective.

Seaton also testified neither the Middle East Emergency Committee nor the Government has any power in the field of prices. He added he has no data on which to form an opinion on the oil-price increases. But he declared: "I believe it would be helpful to know just exactly what the effects of price control would have been on the small independent oil producers, as well as on the supply to Europe."

More hearings . . . The big news in Washington remained the congressional hearings with two twists added.

The twists were a special grand jury and a third committee inquiry. The grand jury was called to meet in Alexandria, Va., March 4. It will study Justice Department charges of price fixing and market splitting by producers, refiners, and pipelines.

This inquiry may run as long as 4 to 6 months. It is related but not directly tied into the recent crude-price increases. The Justice Department is continuing a separate study of those increases to determine if any violation of law was involved.

The Senate commerce committee plans the latest probe of the industry, already under investigation by Senate and House committees. Sen. John O. Pastore of Rhode Island will head up the third one. He said chief concern of the inquiry will be "protecting the captive consumers."

About prices . . . Sen. Joseph C. O'Mahoney, chairman of the Senate joint subcommittee probe, made a threatening noise about prices.

He said in a television interview if the industry doesn't roll back gasoline prices to pre-Suez levels, Congress may have to act.

O'Mahoney also ordered the Middle East Emergency Committee to produce its records on actions taken in the emergency. This prompted the Interior Department to review minutes of M.E.E.C. meetings. It plans to strike

out all classified data before releasing them to the committee.

The M.E.E.C. did get one assist during the week. Atty. Gen. Herbert Brownell, Jr., said the committee has kept within the law. He said all its actions are being closely supervised by Justice Department representatives.

The Senate investigation heard defense officials report that higher product prices will cost the Government an additional $85 million or more this year. Rear Adm. O. P. Lattu, executive director of the Military Petroleum Supply Agency, gave the report. He said his estimate was based on 1956 purchases of 223,000,000 bbl. of products which cost $1,060,000,000.

Independents speak . . . Domestic producers told the hearing any blame for a lag in the European oil program lies with oil companies in the M.E.E.C.

Russell B. Brown, general counsel of the Independent Petroleum Association of America, charged these major companies, and not the independent producers, are responsible for any shortage of oil for Europe. He said they have increased imports from the Caribbean that should have gone to Europe. He added they have continued to process excessive amounts of crude into gasoline. This has reduced crude available for export.

New prices defended . . . The producers drew a sharp line between the oil lift and recent increases in crude prices. They are not related.

The producer does not set the price at which he will sell, W. M. Vaughey, chairman of the I.P.A.A. executive committee, explained. The buyer announces the price he will pay. The buying companies resisted the pressure for higher prices for 3½ years, although there were several increases in steel and labor costs in that period.

Long overdue . . . Present prices also were called "long overdue and inadequate" by William H. Curry, president of the Rocky Mountain Oil and Gas Association.

It is no longer true that one out of nine wildcat wells will hit oil or gas, Curry said. Today, 1 out of 12 makes a find "which may not necessarily be commercial." It takes 14 wildcats to find a new oil well and 42 to find a 1,000,000-bbl. field.

Discovery is more difficult in the Rocky Mountain area than in other regions, Curry continued. The average depth of new wells there in 1955 was 5,056 ft. against the national average of 4,022 ft. Drilling labor costs have increased 36 per cent since 1947, equipment costs 52.3 per cent and incidental expenses 24.4 per cent.

Refiners Speed Up Cutbacks

AMERICAN refiners continued a dramatic cutback of crude runs to stills and shift in plant yields last week. The goal was making available all the extra crude and fuel oil possible for quick shipment to Europe.

Several accomplished the moves by unusual measures.

Shell Oil Co., for instance, advanced overhaul schedules at its Gulf Coast refinery. This made an extra million barrels of crude available.

Shell President H. S. M. Burns said one catalytic cracking unit will be shut down soon. Another plant unit, not scheduled for overhaul until May, also will be taken off stream for repairs "during the critical period."

He said Shell's record of help-for-Europe by February 28 will total 4,000,000 bbl. of crude oil and 1,500,000 bbl. of fuel oil and products.

Gulf cuts deep . . . Gulf Oil Corp. made two sharp refinery cutbacks within a week.

Pittsburgh officials first ordered a 29,000-bbl. cutback in refinery runs. It was achieved by reducing runs at Port Arthur 10,000 bbl. daily, Philadelphia 10,000 bbl., and Toledo 9,000 bbl.

Then a few days later, Gulf added 30,000 bbl. daily to the cutback by temporarily closing down one of the big stills at the Port Arthur plant for overhaul.

Gulf's record in the emergency has been: 56,725 bbl. daily of crude and 7,620 bbl. daily of products from the U. S. to Europe and diverting 60,000 bbl. daily of its Kuwait crude from U. S. to Europe. That's an average of 124,345 bbl. daily.

In addition, it sold 2,400,000 bbl. of crude oil to other domestic buyers so they could release crude.

Texaco's action . . . The Texas Co. reduced runs at its Port Arthur refinery 20,000 bbl. daily last week. All the crude savings will be sent to Europe.

Texaco officials said earlier they had adjusted refinery yields to make 8,800 bbl. daily more of middle distillates with a proportionate cut in gasoline.

Since the emergency, Texaco has averaged sending 104,000 bbl. daily of crude and products to Europe. Its normal shipments averaged 20,000 bbl. daily. This was achieved by stepping up shipments from Trinidad to Britain, buying and drawing down inventories in the Caribbean and Gulf Coast, and diverting Arabian crude from Sidon normally destined to Western Hemisphere.

Impressive list . . . Other refiners joining the stepped-up oil-for-Europe campaign included:

. . . Cities Service cut refinery runs back to 10,000 bbl. daily. It earlier had reduced by 51 per cent its imports of foreign crude.

. . . Indiana Standard has shipped 3,800,000 bbl. of products, mostly fuel oil, to Europe and has reduced inventories by 90,000 bbl. daily. Refinery operations have been switched to get more heating oil, and asphalt operations have been reduced to give more residual oil.

. . . Sohio cut its refinery runs by 5,600 bbl. daily for this quarter.

. . . D-X Sunray reduced refinery runs by 7,000 bbl. daily.

. . . Phillips drew down stocks or produced 4,000,000 bbl. for Europe, shifted yields to get additional 2,000,000 bbl. of distillates and fuel oil, and reduced refinery runs to get another 1,000,000 bbl. for emergency.

. . . Tidewater cut refinery runs 900,000 bbl., cut imports 1,440,000 bbl., diverted tankers, and substituted 400,000 bbl. of Canadian crude.

Earlier Humble, Continental, Anderson-Prichard, Sinclair, and Socony Mobil had announced refinery cutbacks and yield changes to increase oil for export.

Socony's story . . . Socony President Albert L. Nickerson also compiled his company's record in the emergency.

He praised the industry-wide accomplishments, saying: "They add up to what is probably the largest and most rapid shift in distribution of any commodity ever achieved in peacetime."

Nickerson declared the industry has increased normal shipments to Europe by 563,000 bbl. daily during December and January. He added Socony's share of this movement was 64,500 bbl. daily.

But that isn't Socony's whole story. The company rerouted tankers, exchanged crude and products, and shifted its refinery patterns all over the Western World to step up the supply for the affected area.

It also stopped importing 16,000 bbl. daily of Middle East crude and increased its production in Venezuela by 10,000 bbl. daily, and expanded a Venezuelan pipeline.

In the U. S., Socony added 15,000 bbl. daily to the effort by reactivating an 8-in. crude line from Corsicana to Beaumont, Tex., and added 25,000 bbl. daily more by stepping up flow over its East Texas-Beaumont 20-in. line.

At Special News Meeting . . .

Rathbone Speaks Bluntly:

- Oil industry has done a good job helping Europe in the emergency.
- 80 to 90 per cent of their normal demand is being supplied.
- His company alone has furnished nearly half of the oil-lift goal.

Here's Jersey's Answer to Critics

NEW YORK.—The president of the largest oil company in the United States lashed back last week at congressional criticism of the oil industry's effort to supply Europe with oil.

M. J. Rathbone, president of Standard Oil Co. (N. J.), said flatly that the criticism being voiced in Washington is not justified.

"The whole American oil industry has done a good job on this problem," Rathbone said. He added the problem is not yet solved.

Rathbone made his defense at a special news conference which he said should have been called weeks ago to answer critics. Here are highlights of his points:

. . . **Ninety per cent of Europe's** normal oil demand during December was met by companies operating in the Western Hemisphere. The supply came principally from stocks.

. . . **Eighty per cent of that demand** will be met during the first 3 months of 1957, which is the critical period. This supply for Europe will come from current production.

Rathbone says the industry could do better, especially if production allowables in Texas are increased.

What's ahead . . . Beyond the first quarter, Rathbone says four factors will influence the effort. They are:

. . . **Weather.** It could mess up the entire picture. A prolonged cold spell either in Europe or in the United States could throw the whole planning out of kilter.

. . . **Partial use** of Iraq Petroleum Co.'s pipeline system across Syria. I.P.C. says it could begin moving 220,000 bbl. of oil daily within 7 days by bypassing the destroyed pump stations. So far, Syria has shown no inclination to allow the repairs.

. . . **Opening of the Suez Canal.**

. . . **More crude from the U. S.** Rathbone said his company estimates that 200,000 bbl. more oil could have been available for shipment to Europe during both January and February if Texas allowables had been raised. He said Jersey Standard companies asked for the increases.

The Jersey Standard president said that the 80 per cent of demand figures aren't good enough. He says this country must shoot at supplying Europe with 100 per cent of its middle distillate and heavy fuel needs.

"As our allies, they must have this. It's just as vital to us as it is to them," he said.

Gasoline is another matter. Europe can ration gasoline for a long period of time without feeling any real hardship, Rathbone said.

Price boost defended . . . Rathbone also defended the recent crude-oil price increase in the United States. He said it was prompted by the Suez-inspired crisis, but would have come eventually.

His explanation: The price of a barrel of crude was no longer sufficient to meet the cost of replacing the barrel through new exploration and discovery.

Humble Oil & Refining Co., a Jersey Standard affiliate, was the first to post higher crude prices. Other companies met the increase. Rathbone said Humble offered more for crude because it had to pay more to get additional crude when the industry was using "every effort" to move more oil to Europe.

Product increases followed the crude because "refiners have absorbed almost every added cost for nearly 4 years. They were unable to absorb an increase in crude cost on top of that."

Did it alone . . . Rathbone pointed out that the American oil industry met "self-imposed" targets during the past 3 months in supplying Europe with crude.

He stressed the need to do more saying, "it's hard to contemplate our allies in Europe being short 20 or 25 per cent of needed fuels."

He said he can see no justification for the Texas Railroad Commission curbing oil production because of high product stocks in the United States.

"I don't think that's the primary consideration," he said. "Besides we don't think stocks are as excessive as others appear to believe."

He said he doesn't think figures on

product stocks are really a yardstick to the real situation. He pointed out that pipeline fills of products are included in figures on stocks.

Rathbone emphasized he was not posing as a spokesman for the industry. "We can, however, speak for ourselves."

The Jersey Standard president then outlined just what the Jersey companies have done to move needed oil to Europe.

How plan developed . . . Jersey's long-range plan got its start in July immediately after Nasser's initial seizure of the canal. It required a special committee of experts to look for alternative methods of supplying Europe.

The plan called for supplying Jersey's European affiliates with Western Hemisphere oil totaling 50 per cent of normal Middle East supplies. In addition as much Middle East oil as possible was to be supplied from the Middle East by Tapline or around the cape.

When Suez was shut down, Jersey and its affiliates were using 162 tankers. They increased the fleet to 190 vessels and altered their runs in the Middle East-Caribbean-Europe triangle. This was augmented by stepped up operations of Esso Shipping Co. and Panama Transport Co. and their chartered ships between Western Hemisphere ports.

A triumph . . . Plans after Suez closed were to supply 80 to 100 per cent of normal demand of Jersey's European customers.

Rathbone said this program was "somewhat over-fulfilled" in November and December and was "a triumph of coordination and hard work."

Here's what Jersey companies shipped to Europe in November, December, January:

. . . 105,435 bbl. daily of U. S. oil.

. . . 31,520 bbl. daily of extra Venezuelan oil.

. . . 36,950 bbl. daily of normal shipments from Venezuela.

. . . 70,652 bbl. daily of products from U. S. and Venezuela.

This amounts to 244,557 bbl. daily of oil and products.

How they did it . . . Here's Rathbone's account of how Jersey companies produced, bought, gathered and moved the oil:

Humble shipped 9,200,000 bbl. of crude from Baytown and Harbor Island between November 1 and January 31. Humble bought 4,400,000 bbl. of this and furnished the rest from its own inventories and current production.

This was done by "rapid" changes in pipeline systems in West Texas by Humble and companies with which Humble made contracts.

Pasotex Pipe Line Co. reversed its 10-in. line between Yates and Winkler, Tex., and dumped 21,000 bbl. daily into the Humble system. Shell reactivated a 10-in. line between McCamey and Kemper, Tex., and added another 40,000 bbl. This 40,000 bbl. originated in operations of Texas-New Mexico Pipe Line Co. and Gulf-Humble lines from Crane, Tex., which delivered the crude to the Shell line at McCamey. Illinois Pipeline Co. furnished 6,000 bbl. daily to the Humble system at Yates.

In all, the Humble system increased its deliveries to the Gulf Coast by 112,000 bbl. daily.

Esso Standard and Carter went all the way north to the Elk Basin fields in Wyoming looking for crude. They bought 5,000 bbl. daily and have been shipping it in the Platte Pipe Line a full 1,000 miles to St. Louis. There it is transshipped on Mississippi River barges and moved another 1,100 miles downstream to Avondale, La.

The Avondale terminal was "mothballed" last year by Esso Standard. But it is now reactivated and is being operated by Interstate Pipe Line. Carter has since made other contracts which Rathbone calls "abnormally costly" to bring 2,097,000 bbl. of crude to Avondale during the first 3 months of 1957 —an average of 23,000 bbl. daily.

Interstate Pipeline Co. has also turned to barges. Crude which normally moves through a trunk line from Jeanerette Station, La., to Esso's Baton Rouge refinery is being barged 100 miles to Valentine station on another trunk line which had some excess capacity. This adds another 10,000 bbl. daily to the movement to the gulf.

Inventories cut . . . In addition to this transportation and production juggling, Rathbone said all Jersey affiliates reduced inventories to "minimum working levels" at all points which could contribute to Europe's supply.

Refinery yields of heating oils were increased by 675,000 bbl. in December (compared with November) and another 835,000 bbl. in January. On February 1, refineries in the U. S. cut back crude runs and made another 58,000 bbl. daily available for shipment to Europe.

Rathbone said in most cases these actions were taken or planned by Jersey affiliates before the U. S. Government decided to assist in meeting the emergency. They have not required the sanction of the M.E.E.C., he said.

The big crisis may come in the weeks immediately ahead. Getting enough oil to Europe from now on depends, Rathbone says, on several unpredictable factors including weather in the U. S. and increased supplies in the U. S. Gulf.

Humble Adds Cat Cracker: Old foundations reaching down as far as 15 ft. are being dug out of the ground to make way for a 55,000-bbl. fluid unit at Humble Oil & Refining Co.'s Baytown refinery. Site preparation will be completed and work on the cat cracker started this month. It will be the third of its kind in the huge 313,000-bbl. refinery—largest in Texas. The new unit will boost cat cracking capacity to 165,000 bbl. per day. It will go on stream next year.

Oil-Country Steel Hiked

● Prices on tubular goods increased by 3.5 per cent; it means a $40-million jump in oil industry costs this year

THE oil industry weathered a double whammy last week:

. . . Congressmen continued loudly to call on oil men to justify recent petroleum price increases, the first in nearly 4 years.

. . . Steel makers quietly handed the industry a multimillion dollar increase in the cost of its basic tools, the second in 6 months.

The steel-price increase, averaging about 3.5 per cent, underscored what oil men have protested for months: Since the last previous oil price hike the industry has absorbed five rounds of increases in basic steel prices and four rounds of wage increases.

Steel's latest upward move was in mill prices of selected items and so-called "extras" rather than in basic prices. However, the effect was the same. On top of this, the oil industry will face up to its fifth round of wage increases next month.

The case of each price increase—steel, oil, or labor—the justification has been the same: Mounting costs. But only oil has been summoned to defend its prices with public opinion. (For news on congressional investigations see page 102.)

What hike means . . . Price increases announced in steel items last week average about $7 a ton. They will add, by conservative estimates, nearly $40 million to oil industry costs this year.

Involved in the price rise were standard and line pipe from 2 in. to 12 in.; all sizes of buttweld pipe; oil country casing, tubing, and drill pipe; and carbon-seamless mechanical and pressure tubing. The larger sizes of steel pipe got a similar price raise about 3 weeks ago.

Besides these items prices on a wide variety of steel products have been boosted or charges made for extras within the last 2 months. Among them were strip and sheet, plates and structurals, bars, rods, wire and alloy products. All are used by the oil industry.

United States Steel Corp. took the lead in raising mill prices for items affecting the oil industry. Other steel makers began quickly following. It was the broadest increases since the price adjustments started 2 months ago. The last general increase in basic steel prices came in August 1956, when hikes of $8.50 a ton went into effect.

The new prices on pipe ranged from $4 to $9 a ton and averaged about $6.50 a ton. With the oil industry using an estimated 3,200,000 tons of pipe a year, on that basis this means an increased pipe bill of $20.8 million.

Prices on casing, tubing, and drill pipe ranged from $6 to $8 a ton more, averaging about $7. On the basis of 2,400,000 tons of steel being used for these items, the added tubular bill will be $16.8 million.

These tote up to $37.6 million and don't take into consideration the increased prices on plates, bars, rods, and wire consumed in oil drilling, production and refining. They also are on top of the $75 million a year extra steel bill handed the oil industry only last August *(The Oil and Gas Journal, August 13, 1956, page 86).*

Well costs to climb . . . For the oil man, the new steel prices mean added costs all along the line. But he will be hit first in drilling.

He can count on his average well costing him at least $350 more to drill and the average deep well $560 more. The average well is 4,000 ft. and requires 12 to 13 tons of steel per 1,000 ft. or about 50 tons over-all. The average deep well takes 80 tons of steel.

The $16.8 million figure for added costs on casing, tubing, and drill pipe actually is conservative. It is based on an estimated production of about 2,400,000 tons of steel for these items. The industry expects to drill 60,000 wells in 1957. On the basis of only 50 tons of steel per well—and the deeper ones take more—the extra cost will approach $21 million.

But an end to higher steel prices probably is not in sight. At least one and maybe two increases in basic prices may be effected before steel's 3-year wage contract with its unions expires in 1958.

When the first basic increase was posted last summer, many steel makers expressed dissatisfaction with the hike. They thought it should be about $1 a ton higher in view of the wage increase. Many predicted readjustment would have to be made before the second basic hike set for this summer.

Steel spokesmen said the mid-winter increases were needed to offset higher costs of coal, iron ore, freight, scrap, and wages. Steel companies recently granted workers a 3 cents an hour automatic wage boost under a cost-of-living clause in their labor contract.

Here's How Steel Prices Have Increased

Type—	—Increase, dollars per ton— August '56	February '57
Buttweld pipe, ½-4-in., black and galvanized	$12.00	$4.50-6.50
Seamless pipe, 2-4-in., black and galvanized	12.00	6.50
Seamless plain end line pipe and trunk-line pipe, 3½-12¾-in.	11.50	6.50-9.00
Electric weld line pipe, 14-36 in.	9.50-11.50	4.00-7.00*
Oil country casing, J-55, short T&C	13.75	6.00-8.00
Oil country tubing, J-55, all sizes	14.25	6.50
Drill pipe, D, internal upset T&C, all sizes	21.25	7.00

*Increase made in January 1957.

Costly Apco Test Dry

Red tape boosted expenses of duster in disputed area

NEW ORLEANS. — Anderson-Prichard Oil Corp. has abandoned a costly offshore wildcat where drilling had been delayed several months by legal red tape.

The test, in Block 39 of East Cameron area, was the first to be spudded in the disputed area off the Louisiana coast following a truce between the state and federal governments.

The company spent about $400,000 for idle drilling equipment at the rate of $4,400 a day while awaiting a permit to drill *(The Oil and Gas Journal October 22, 1956, page 70).*

Deep Water Exploration Co., Houston, spudded the test last October within hours of a federal-state pact opening the disputed area to further drilling. The well was abandoned last week at 14,495 ft. It reportedly found no commercial oil or gas.

The oil company had gone all the way to the Supreme Court seeking a drilling permit during the long stalemate over offshore jurisdiction. In addition to paying for a drilling tender on a standby basis during nearly 4 months of fruitless negotiations, Anderson-Prichard also paid rental to both the state and federal governments to safeguard its lease. Total cost of the well is estimated at over $1,000,000.

Anderson-Prichard also has abandoned three other locations near the wildcat failure.

B.P. Moves Into Canada

● New Montreal refinery, string of service stations in Quebec put firm on integrated footing in North America

MONTREAL. — British Petroleum, Ltd., one of the world's largest oil companies, is planning its first integrated operation on the North American continent.

B.P. is entering one of the world's fastest growing oil markets with a new refinery at Montreal and marketing facilities in the Province of Quebec. Its plans were signaled by these moves last week:

. . . Purchase of a 600-acre site in Ville d'Anjou, eastern Montreal Island, for a 30,000-bbl. daily refinery.

. . . Acquisition of choice service-station sites in Montreal and elsewhere in Quebec.

While this will mark B.P.'s debut in Canadian refining and marketing, it is not its first interest in Canada. Back in December 1953, the company acquired an interest in Triad Oil Co., Ltd., of Calgary.

This interest is now being increased to 50 per cent. Triad is actively engaged in oil exploration in western Canada. It now has a substantial interest in 6,000,000 acres in Alberta, British Columbia, Saskatchewan and Manitoba.

Spotlights Canada . . . British Petroleum's entrance into the Canadian market is another indication of the optimism oil capital holds for the U. S.' northern neighbor.

Huge sums of American capital have moved into Canada in the past decade. More recently substantial British and other European capital followed. Most notable example was the organization of Canadian Fina Oil in 1950 and its subsequent expansion to Canadian Petrofina, Ltd., in 1953.

The refinery . . . Details of the refinery B.P. will build at Ville d'Anjou have not been disclosed.

"When fully completed," the announcement said, "it will have a capacity of approximately 30,000 bbl. per day. The total investment is likely to be in excess of $30,000,000."

One thing is sure: Moving into a highly competitive area, the B.P. refinery is forced to have most up-to-date processes. It certainly will have catalytic cracking, probably in the range of 15,000 bbl. daily, and catalytic reforming, possibly about 9,000 bbl. daily. It likely will include hydrogen treating, alkylation, and possibly polymerization.

British Petroleum will be the sixth company to refine oil in Montreal. Others already in the picture are British American, 40,500 bbl. daily; Canadian Petrofina, 20,000 bbl.; Imperial Oil, 69,000 bbl.; McColl-Frontenac, 55,000 bbl.; and Shell, 58,400 bbl. British Petroleum's 30,000 bbl. will bring the total refining capacity of the city to almost 275,000 bbl. per calendar day.

Crude source . . . Like other Montreal refineries now in existence, the B.P. plant will operate on foreign crude.

Since British Petroleum's principal foreign oil source is Kuwait, the new refinery likely will process that type of crude.

The refinery will be located about 3 miles inland from the St. Lawrence River. This means pipelines must be built from the river to the refinery site. Docking facilities on the river will also be built. Negotiations for the pipeline right-of-way and for docking facilities are near completion.

The company will operate in Canada under the name of British Petroleum (Canada), Ltd. Its main offices will be in a new building at 550 Sherbrooke Street West, Montreal. Several hundred persons are to be employed in the head office and Quebec division staff. More will be needed in the refinery, marketing and distribution offices.

Marketing . . . Construction of service stations in Montreal and other Quebec consuming centers will be started this spring.

Sites for many stations already have been obtained. The stations will be uniform and distinctive in design. This will require a heavy investment over and above the $30,000,000 planned for the refinery.

The Canadian newcomer is an old timer in oil. British Petroleum Co., Ltd., has held that name only since 1954. But its predecessors, Anglo-Iranian Oil Co., Ltd., and Anglo-Persian Co., Ltd., have been in existence since 1909. An idea of its size can be comprehended from these facts:

Last year the B.P. group produced more than 1,000,000 bbl. of crude oil per day. Its major source is Kuwait, which it shares with Gulf Oil Corp. Other holdings are Iran, where it has a 40 per cent interest, and Iraq.

Throughput of its refineries exceeds 250,000 bbl. daily. Its 14 refineries are located in Great Britain, Aden, Australia, Belgium, France, Germany, Israel and Italy. It also has an interest in the huge Abadan, Iran, refinery.

B.P.'s tanker fleet numbers more than 150 ships with a combined deadweight tonnage of more than 2,200,000 tons. This does not include an equal amount of tonnage under charter. B.P.'s tanker fleet is one of the largest in the world.

In addition to its Middle East production, B.P., through associates, is looking for oil in Great Britain, Australia, Malta, Trinidad, East and West Africa and, through Triad, in Canada.

Where Texas won its independence:

Mexican-Gas Line Fords Ship Channel

HOUSTON.—Natural gas from Mexico will move to U. S. markets across the San Jacinto Battleground area, where Texas won its independence from Mexico more than 120 years ago.

Texas Eastern Transmission Corp.'s new pipeline from Mexico was laid across the Houston Ship Channel last week. The crossing is almost within the shadow of the San Jacinto Monument commemorating Texas' independence.

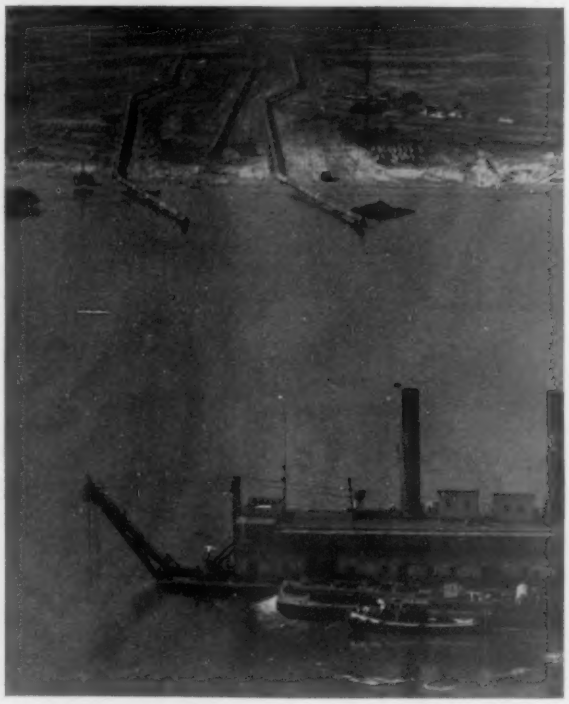
Traffic on the waterway was halted for a few hours on 2 separate days last week as Brown & Root, Inc., pulled dual strings of 30-in. pipe across the channel. The lines are to be buried 50 ft. beneath the channel.

Advance planning and fast work by Brown & Root crews permitted traffic interference on the busy waterway to be held to a minimum.

The twin lines were prebent to conform to the contour of the channel bottom (see photo at right). Sideboom tractors pulled the lines along temporary tracks extending almost to water's edge. From there, the precoated pipe was quickly floated across the channel for lowering into the trench.

Each of the 30-in. strings was 1,400 ft. long and weighed more than 1,000,000 lb. The 30-in. line, together with concrete, weighs 715 lb. per foot.

The channel crossing is one segment of the 30-in. system which will extend 422 miles from the Rio Grande near McAllen, Tex., to Texas Eastern's Vidor station near Beaumont. It will move 115,000,000 cu. ft. of Mexican gas daily to meet expanding needs of Texas Eastern customers in Pennsylvania and New Jersey. The Mexican link is scheduled to be finished by fall.



Gas Shortage Feared

● Exploration hinges on higher rates, Phillips attorney tells FPC as hearings resume on famous rate case

WASHINGTON. — A natural-gas shortage will crop up in 10 years unless discoveries are increased far beyond their present level.

That's the prediction of H. K. Hudson, attorney for Phillips Petroleum Co.—the nation's largest producer of natural gas.

Hudson told the Federal Power Commission that the only way to avert future scarcity is to allow producers prices at which they can keep on finding and developing new reserves.

This was brought out last week when the FPC resumed hearings in the Phillips rate case. It was this case that led to the Supreme Court's extension of federal control to independent producers in 1954.

Once again the case is arousing wide interest. It's the first case since the Supreme Court decision involving all the interstate sales of a large producer.

Twelve per cent return . . . Hudson said a 12 per cent rate of return is necessary if Phillips is to continue finding and developing adequate gas supplies. This is based on a cost study.

The interest of the consumer is not confined to current prices for gas, Hudson argued. The consumer's interest is equally "if not more" in the continuance of supplies. He warned that low prices to producers cannot continue if consumers are to be served.

Distributors were cautioned not to be complacent because they have acreage dedicated to them which they believe will supply their needs for some years. While the distributors want increased exploration and development, they feel it is of more interest to others than to themselves.

"Nothing could be further from the truth," Hudson said.

"The pipeline companies are fully aware of this fact and are conducting exploration operations and acquiring and developing leases at points far distant from their pipelines.

"Price is the only incentive which will bring the needed exploration and development," Hudson declared. "That is equally true for lands under present contracts as well as for new unexplored and uncontracted areas."

In the light of these factors none of Phillips' rates exceed that necessary for the company to continue to supply present gas volumes. But the company is not making even a reasonable return on interstate sales, Hudson said.

The reserve picture . . . Natural gas is no longer merely a sideline of the oil industry, Hudson pointed out. It is not found by producers looking primarily for oil. It is the object of intense search in its own right.

Much of today's exploration and drilling money is spent in the deep, very high-cost offshore areas. Less than half of the gas now selling comes from the shallower dry gas wells which formerly supplied most of it.

Present gas reserves equal about 22 times the annual rate of production, Hudson said. But producing ability of wells and reservoirs drops much faster than the rate of decline of the reserves. For that reason, it will be necessary each year to find about 1½ times as much new reserves as the volume produced, or the pipeline will "soon start running short."

Phillips reserve engineers will later testify on the supply picture. They will show that the California reserves are dwindling. The Appalachian fields are fast becoming storage reservoirs for gas from the Southwest.

Future pipelines . . . The Permian basin, which supplies about 12 per cent of present gas, is declining. Unless there are discoveries far in excess of the present rate, the basin probably has seen its last new major pipeline or loop. The same is true of the Panhandle-Hugoton, San Juan and Monroe fields, Hudson said.

"It appears likely that the new line projected to Florida may be the last major pipeline out of the Gulf Coast," Hudson said. "Discoveries in the offshore area of the gulf will have to be enormous just to meet the present markets."

New Firm to Build Big Barge

NEW ORLEANS.—Blue Water Drilling Corp., a new offshore drilling firm, has announced plans to construct a mobile drilling barge similar to the "Kermac 46."

Owners of the new firm are Olin Oil & Gas Corp.; Mississippi River Fuel Corp.; Austral Oil Exploration Co., Inc.; and Crescent Drilling Co., Inc. Harold F. Moses, Olin president, is president of the new company. Completion is expected next summer.

Industry briefs

Oil Center Tool Co., Houston, has been sold to Food Machinery & Chemical Corp. The deal involved acquisition of more than 98 per cent of Oil Center's 90,000 shares. Food & Chemical has other oil-industry subsidiaries: Peerless Manufacturing Co., Well Equipment Manufacturing Corp., and Chiksan Co. Oil Center produces wellhead equipment.

A compromise bill to increase Arkansas' oil-severance tax on major producing wells by 1 per cent has been passed by both houses of the legislature. It will bring the total tax to 5 per cent.

The increase will not apply to stripper wells with daily production of 10 bbl. or less. The administration of Gov. Faubus, which pushed the bill, had originally asked for a blanket increase on all wells. The exemption was tacked on after producers argued that a tax increase would put marginal-well operators out of business.

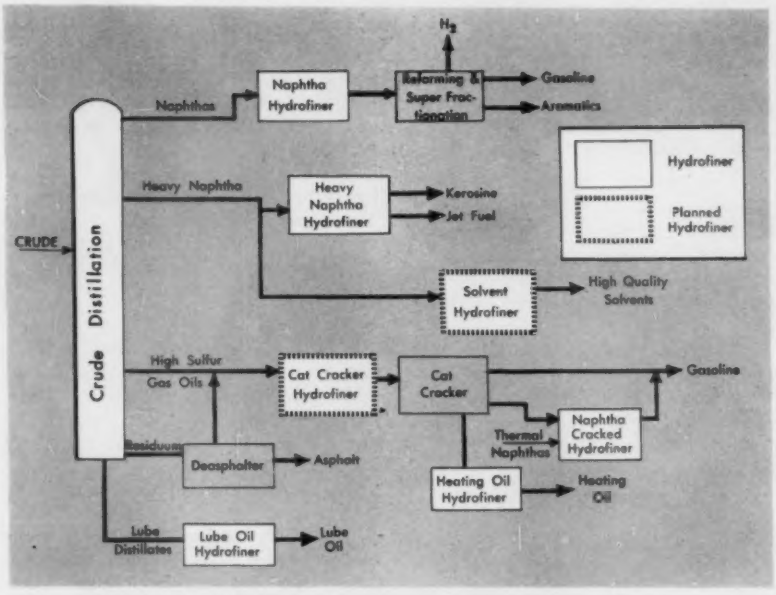
Merger of Cameron Parish Corp. into Western Natural Gas Co. is now complete. Paul Kayser, Western Natural president, said the company had issued 800,000 shares of stock for Cameron assets. Myron Ratcliffe and S. Gordon Glaysher, both of Cameron's management, were elected to the board of Western Natural. Glaysher also was elected vice president.

A stepped-up exploration and develment program may be coming up for Western Decalta Petroleums, Ltd., of Calgary. Two London investment houses have agreed to a $6,150,000 financing arrangement with the company.

Central Mining & Investment Corp. and Selection Trust, Ltd., will underwrite 1,000,000 shares of Decalta stock and will lend the company $4,500,000. The group has an option to acquire more than a million additional shares of stock.

Spud Valley Gold Mines, Ltd., Vancouver, has purchased Montana oil properties from William M. Hanlon of Roundup, Mont.

The transaction included equipment and an undisclosed number of oil wells in Big Wall field of Musselshell County and Cat Creek field in Petroleum County, plus the 600-bbl. Jet Fuel Refinery near Mosby. The agreement calls for initial payment of $300,000, with the balance to be paid in 6-month installments over the next 3 years.



HERE'S WHERE HUMBLE will use hydrogen treating at Baytown.

Hydrogen Boom Boosted

● **Humble program will put it ahead in Hydrofining, plans facilities to treat 64 per cent of total crude capacity**

HOUSTON.—Humble Oil & Refining Co. has launched a hydrogen-treating program that will put it out front in this growing refinery process.

George Shepherd, Humble engineer, last week gave a regional meeting of Western Petroleum Refiners Association an insight into Humble plans. He said when units planned and now under construction are completed, Humble's Hydrofining capacity will equal 64 per cent of total crude capacity.

Humble's program underscores the bright future of hydrogen treating. More and more refiners will use it on naphthas. It also will move into the production of chemicals and fuel products and in hydrocracking of residuals.

The outlook . . . Present Hydrofining capacity runs about 750,000 bbl. This is less than 8 per cent of total crude capacity.

Present predictions see a rise to 32 per cent of crude capacity by 1960 and 36 per cent by 1965. This still will put the industry's average in Hydrofining well below Humble's goal.

Catalytic reformers, now commonplace in refining, are making hydrogen treating especially attractive. They are providing a ready source of hydrogen. It's been a natural step to take the cheap reforming byproduct and use it to upgrade refinery streams.

But Shepherd said even when this hydrogen-feed source eventually dries up hydrogen treating still will be in the picture. Refiners already are looking at ways to make hydrogen specifically as a treating agent.

At present, yield of hydrogen from reforming will vary from 800 to 1,300 standard cubic feet per barrel of naphtha charge, depending on severity of operation. This compares with an over-all yield of from 140-180 s.c.f. of gas per barrel of crude charged.

Built-in hydrogen . . . A look at Humble's typical flow pattern shows the extent to which Hydrofining is being incorporated into the process scheme.

Only a representative operation can be shown, however, since the over-all picture is flexible and the units can be shifted into different services depending on demands.

At Humble's Baytown plant (see flow diagram), crude is processed through crude distillation units and then:

. . . Light naphthas are treated prior to being charged to catalytic reformers. This is the most prevalent use in the country today. It is primarily a sulfur-reduction step.

. . . Heavy naphthas are Hydrofined to remove sulfur and improve burning characteristics of kerosines and jet fuels produced from these stocks.

. . . Solvents will be treated in a unit now planned. That will make high quality, odorless products.

. . . Heating oils from cat-cracked stocks are treated for stability, compatability, sulfur, burning characteristics, and odor.

. . . Gas oils are mixed with deasphalted oil as a cat-cracker feed. These will be treated to remove sulfur for a higher octane in cracked naphtha. Treatments also will reduce carbon-forming components, remove metal contaminants and reduce aromatics.

. . . Cracked naphthas are treated to improve engine cleanliness when blended to gasolines.

. . . Lube distillates are treated to improve color and stability.

Some extras . . . Humble also has found the process is suitable for converting heavy residuals to light residuals and hydrogenating asphalt to lighter materials.

In hydrogenating a West Texas asphalt, 54.8 volume per cent of the charge was converted. Some 31.2 per cent of the total charge resulted in gas oil, 16.4 per cent heating oil, and 12.1 per cent gasoline. Hydrogen consumption will vary considerably when converting asphalt, ranging from 300 to 1,000 cu. ft. per barrel. Hydrogenation of West Texas asphalt, however, will be on the high side.

Shepherd reported it's both possible and practical to treat the whole crude stream. But this move has its limitations. Most plants are set up for a variety of operations already, he said. Cost would be too much to junk that investment. But it could be considered when a new plant is built.

Finger-Tip Figures on Refinery Building

WATCH for a new monthly feature—Refinery Construction Report—beginning in the Journal's February 25 issue.

It will keep you up to date on the "who, what, when, and where" of refinery construction in the U. S. and Canada.

The report will be divided into four units—West Coast, East Coast, Mid-Continent, and Gulf Coast. All except the Gulf Coast unit will cover a section of Canada.

One unit will appear in the last Journal issue of each month. Three times each year you will find a complete report on all four units. The Journal's Canadian issue will carry a complete report on Canada.

Tax Case Under Way

Calco challenging levy on Colorado production gross

DENVER.—Hearings on The California Co.'s suit challenging the constitutionality of Colorado's gross income tax on oil and gas production are under way in Denver District Court.

Presiding Judge Edward J. Keating estimated the trial may last 6 weeks. At stake is about $10,000,000 paid to the state by major oil companies, much of it under protest, since the levy was enacted March 27, 1953.

Most of the money has been spent by the state—and officials predict "financial chaos" if the law is knocked out. The District Court decision will be appealed to the Colorado Supreme Court, whichever way it goes.

Calco, largest producer in the state's Rangely field, brought the action against the state revenue department July 6, 1955. The firm contends the tax is unconstitutional and discriminatory.

The contention . . . Fred M. Winner, special counsel hired by the state, opened the defense with a claim that Calco contends interstate commerce of oil begins at the point of production—the bottom of the well, not the wellhead.

If so, Winner argued, the state could no longer regulate even the production of oil and gas, and the entire industry would come under federal regulation.

He was referring to a Calco argument that there is no legal basis for the tax, that it is an unreasonable burden on interstate commerce in violation of the U. S. Constitution.

A proposed constitutional amendment pending in the Colorado Legislature would permit levying a true severance tax on oil and gas production. It is regarded as a safeguard to fill the gap should the courts kill the present tax.

Sun Orders 10,000 Pumps

PHILADELPHIA.—Sun Oil Co. has placed a gigantic order with Wayne Pump Co.—for 10,000 gasoline pumps.

It's part of Sun's automatic custom-blending program, which is being expanded throughout Sun's 21-state marketing area. Motorists will be able to select one of five different grades of gasoline from the same pump.

The big decision to switch completely to automatic blending came after a successful 9-month trial in Florida *(The Oil and Gas Journal, December 10, 1956, page 84)*. Not only is it a revolutionary step in gasoline marketing, but it is also a big departure from Sun's traditional single-grade selling.

watching WASHINGTON

. . . with Bertram F. Linz

Washington merry-go-round . . .

THERE'S quite a squabble in Washington over whether the Government has authority to control oil production and prices. Some, including the President, say yes. Others, including Mobilization Director Flemming, say no.

The lineup on the President's powers and the need to use them is confusing. But so is the problem.

President Eisenhower told a news conference he could regulate both production and prices if it became necessary.

Flemming, Assistant Secretary of the Interior Wormser, and department oil officials said there is no law permitting control of either.

Members of Congress said Eisenhower should step in immediately to increase the lift to Europe. But State Secretary Dulles said the situation isn't that bad.

Sen. Estes Kefauver sharply rapped Wormser for failing to keep oil prices down. But price control was dropped in 1953 and had been ineffective for months before. And the Government has never tried to control production, even during World War II.

A bureau reports . . .

INTERIOR SECRETARY FRED A. SEATON looked over the work of his Bureau of Mines in 1956 and found it pretty good.

He sent a report to the President over the weekend, detailing what the bureau did during the year. He cited more than 80 cases in which it had aided progress in the oil, mining, and metal industries. Here are some of the things it did in oil:

A bureau report answered puzzling reservoir-appraisal questions. Another pointed the way to efficient secondary recovery at deep reservoirs.

Three purified organic nitrogen compounds were prepared as reference standards in working out techniques for concentrating nitrogen compounds from crude. And thiophene was identified in Wilmington, Calif., crude. Thiophene is an aromatic-type compound similar to benzene, except that it contains sulfur.

Heats of combustion and formation were worked out for tetraethyl lead, solving a difficult problem of long standing. Samples of oil shale from the tristate region of Colorado, Utah, and New Mexico were analyzed, resulting in extension of known reserves.

The new man at ODM . . .

ASSISTANT SECRETARY OF DEFENSE GORDON GRAY will take over a lot of unfinished business when he succeeds Arthur S. Flemming as mobilization director.

Whether he will take over Flemming's policies as well as his problems is something the oil industry is trying to guess. On the record, Gray is a "liberal." In 1950, he wrote a report to President Truman on economic policies. There he supported continued tariff cuts, limitation of subsidies for shipping, and repeal of the Buy American Act. There was no outright stand against quotas. But there was no support for them, either.

Gray's report was written only a few months before the outbreak of the Korean war. Conditions today are far different.

So far as oil quotas are concerned, Gray isn't seen likely to take a stand contrary to administration policy. That policy, strongly backed by the State Department, is against quotas. Congress found that out every time the subject came up.

A new try for quotas is due to be made in Congress this year if signs point to a new import flood when the Suez Canal is reopened. This time, unless the administration can point to concrete results from its voluntary program, it will be pressed vigorously, observers say.

SMOOTH IS THE WORD for labor relations at Magnolia's Beaumont refinery. W. E. McKellar, Jr., assistant manager of industrial relations, tells the W.P.R.A.:

How to Avoid Labor Problems

HOUSTON. — Magnolia Petroleum Co. has learned how to get along with union men at its Beaumont refinery. Its formula: When possible, prevent disputes from arising. Otherwise, solve them before they can spread.

To maintain smooth relations between management and labor, Magnolia has borrowed one of the basic concepts of Alcoholics Anonymous. It tries to avoid pitfalls on a "day by day" basis.

The Magnolia program, however, is not a near-sighted one. Labor and management teams, meeting jointly once a month, not only try to dissolve current tensions but also look ahead to settle troublesome issues before they erupt.

One of the main ingredients in Magnolia's labor-relations program, according to W. E. McKellar, Jr., assistant manager of industrial relations at the Beaumont plant, is "a properly conditioned management."

McKellar believes that one of the worst pitfalls in labor relations is "failing to recognize the personal dignity of every man in the organization—from top to bottom."

"Treat your fellow workers with respect," McKellar advised the Western Petroleum Refiners Association at a recent regional meeting in Houston. "Remember their intelligence and their personal dignity and you'll find they will respond to a sound program of labor relations. Men take pride in being a part of a company where labor disputes are few and strikes a rarity."

How successful has the program been?

Magnolia's experience . . . Most union workers at the Magnolia plant are represented by the Oil, Chemical & Atomic Workers International Union. This work group, known as the "yard unit," includes more than 2,400 persons out of a total union force of slightly more than 2,600.

Magnolia signed its first contract with this unit in 1944. The following year there were 34 formal grievances filed. The number dropped to 31 in 1946. By 1949 the number was down to 16, and in 1954 it reached a low of 3. In 1956, which McKellar described as a "bad" year, 8 formal grievances were filed. Four of these were withdrawn after they had been put in writing.

"We have not had a dispute settled by an arbitrator since 1951," said McKellar, "and we have only had three such cases in the history of this bargaining unit."

But all the benefits haven't gone to the company. The Beaumont local set the national pattern for O.C.A.W. units last February when it accepted the company's proposal for a general wage increase. The contract will expire in June, and negotiations for a new agreement are scheduled to start in April.

The Magnolia refinery was one of the first on the Gulf Coast to sign a contract providing equal job opportunities for Negroes. Thirty-four Negroes now have jobs formerly held only by white men in the process mechanical division.

"And we haven't had a single repercussion of any kind," said McKellar. He admitted, though, that management has "had to talk to a couple of people" who objected.

McKellar said some persons assume the company has "capitulated" to the union, thereby avoiding grievances. His reply: "Any company following such a practice could not maintain its competitive position in the industry."

Rigid contract . . . Magnolia believes in a clear labor agreement reached through local, rather than national, bargaining.

"There is no attempt to bypass, undermine, or circumvent the union in any matter to which they should be a party," McKellar said. "To the contrary, when our management signs a labor agreement it becomes a binding contract to be followed to the letter and in the spirit with which it was negotiated."

Plant supervisors are asked to offer ideas and suggestions to be written into contracts.

Although contract negotiations are conducted on a local level, McKellar admitted that "the policy committee of the O.C.A.W. International and its industry-wide demands cannot be ignored." Management studies trends in labor agreements both in the oil industry and in other industries before making its contract proposal.

Foremen training . . . When a new contract has been signed Magnolia conducts a series of training sessions to acquaint foremen with terms of the agreement.

"If the foremen are to administer the agreement they must be familiar with its contents," McKellar said. "Meetings must be held with the supervisory force and the labor agreement fully explored. This is a major task and the results which are achieved will largely dictate the labor peace you will enjoy during the contract term."

Many of the complaints heard by foremen are passed along at the monthly meetings of management with the workmen's committee. Either party can bring up matters to discuss.

Through informal discussions, McKellar said, "many of the troublesome contract items are disposed of month by month, thereby minimizing the issues to be resolved when contract renewal time arrives."

By keeping in touch with union workers and detecting changes in their sentiment, the company is able to prevent disputes from smoldering.

"When they do become visible," McKellar warned, "you'll awaken with the rude realization that they are out of control.

"We operate on the basic principle of working each day without a single labor dispute of any significance."

Gulf Hits Offshore

Louisiana test taps three zones south of Timbalier

HOUMA, La.—Gulf Oil Corp. has completed a prolific wildcat more than 4 miles south of its large Timbalier Bay field in the Gulf of Mexico off Lafourche Parish.

It opens Louisiana's fifth offshore field this year. Location is on State Lease 1423, in Block 21, South Timbalier area.

The discovery well is productive from two deep Miocene sands, one perforated at 10,615-33 ft., and the other at 10,215-30 ft.

From the deeper zone, the well flowed 404 bbl. of 30.4°-gravity clean oil daily through 7/64-in. choke with pressure of 4,675 psi. and gas-oil ratio of 725 cu. ft. per barrel.

The upper pay tested 379 bbl. of 30.6°-gravity oil per day through 7/64-in. choke with pressure of 4,265 psi. and gas-oil ratio of 760 cu. ft. per barrel.

Gas zone . . . The well, drilled to 11,000 ft., also has an indicated prolific gas zone at 10,810-10,922 ft. This was tested but operators decided to complete in the two higher oil sands.

Nearest production is in Gulf's Timbalier Bay field, associated with a large, shallow piercement-type salt dome at the mouth of Timbalier Bay. It was discovered in 1938, and now is one of South Louisiana's larger fields. Production, from multiple sands ranging in depth from 3,500 ft. to below 13,000 ft., is about 26,000 bbl. daily.

Drilling Island Work Started

VENTURA, Calif.—Richfield Oil Corp. expects to start work on the first artificial island on its 1,175-acre lease offshore from Rincon by the first of next month.

Finishing touches were being added to the construction dock and a surveying crew was at work plotting the precise location of the island. Preliminary work indicated the island will be built in 45-ft. of water approximately 3,000 ft. from shore. Total surface area of the island will be 3 acres with a net working area of about 1 acre.

Guy F. Atkinson Co., San Francisco, has the construction contract.

Richfield originally planned to build two islands on the lease. The tentative plan for the second island called for it to be built in 64-ft. of water more than a mile from shore. The construction of this second island will await results from drilling on the first island.

Processing briefs

Southeastern Saskatchewan may get a new natural-gasoline plant. Six companies are talking over the possibility with the provincial government. In January, the mineral resources department cleared the way for the filing of applications. Since then, companies from Colorado, Texas, Oklahoma, California, Saskatchewan, and Alberta have shown an interest. Names were not released. Cost of the project is estimated at $15,000,000—about half for the plant, and half for pipeline and gathering facilities.

Tidewater Oil Co. is a notch closer to putting its big 130,000-bbl. Delaware Flying "A" refinery in full-scale operation. The latest to go on stream is the 5,000-bbl. sulfuric alkylation unit. It makes aviation and motor alkylate from isobutane and butylene. The process is licensed by M. W. Kellogg Co.

Other phases in operation are the crude unit, the Orthoflow fluid cat cracker, gas plant, and poly plant. Coming up are the Houdriformer, fluid coker, cat hydrodesulfurizer, Udex unit for the cat reformer, hydrogen plant, and the sulfur recovery plant.

Douglas Oil Co. of California has started a $1,500,000 expansion program at its Bakersfield refinery. The project includes a new 12,000-bbl. crude distillation unit, a laboratory, a Unifining unit, and a 10 per cent increase in the thermal-cracking plant.

The unifining and thermal-cracking phases of the program are slated for completion in June. Douglas is also building a research laboratory, an emulsion plant, and is expanding its crude distillation facilities at its Paramount asphalt plant. The company is considering plans for another asphalt plant at Paramount.

Construction has begun on Hydrofiner No. 3 at Esso Standard Oil Co.'s Bayway refinery, Linden, N. J. The 15,000-bbl. unit will process sour light virgin naphtha, improving color and odor and reducing corrosive properties and gum-forming tendencies.

When the unit is completed, Esso's first Hydrofiner will be switched from thermally cracked naphtha to heating oil, adding 7,600 bbl. per day to the present capacity of 19,500 bbl. now used to process cracked heating oil. Esso personnel is handling the construction of the new unit.

British American Oil Co., Ltd., has awarded a $4,000,000 engineering and construction contract for additional offsite facilities at its 21,500-bbl. refinery at Clarkson, Ont., to Fluor Corp. of Canada, Ltd. The new facilities will serve a reformer and crude unit now being built. Fluor holds contracts amounting to more than $7,000,000 for construction projects at the Clarkson plant.

Ethyl Corp. has awarded a contract to C. F. Braun & Co. for construction of its TEL plant at Pittsburgh, Calif. The installation, to be located adjacent to the Dow Chemical Co. plant, will produce antiknock fluid for Ethyl's West Coast customers. Completion is scheduled for the middle of 1958.

Also for Refiners . . .

Comparisons show oil prices are below other costs (P. 100) . . . Domestic refiners are cutting runs, adjusting yields to meet Europe's needs (P. 103) . . . M. J. Rathbone, Jersey Standard president, tells how his organization is meeting the Suez crisis (P. 104) . . . British Petroleum is making its bid to become an integrated company on the North American continent by announcing plans to build a 30,000-bbl. plant at Montreal East (P. 107) . . . Humble has plans on the drawing boards to increase Hydrofining capacity at Baytown to 64 per cent of the crude charge (P. 110) . . . W.P.R.A. hears how to clip refinery labor problems in the bud (P. 112) . . . Esso Research has bought a research-lab site (P. 116) . . . New refinery is among recent Russian oil gains (P. 120).

PLUS THESE TECHNICAL FEATURES: Automation: Where it is today and where it will be tomorrow (P. 121) . . . In a special report, the Journal's engineering editor also explains the ins and outs of automation in process control (P. 122) . . . The automatic control system (P. 123) . . . Process stream analyzers (P. 127) . . . Data handling (P. 130) . . . and Electronic computers (P. 133) . . . Refiner's Notebook (P. 171) . . . The Foreman's Page (P. 173) . . . and PETROdatics (P. 175).

Cogdell Unit Peps Up

Big flood hiking input wells to 32, water injection to 50,000 bbl. per day in bid for 60,000,000 bbl. more oil

SNYDER, Tex.—The Texas Co. is about ready to yank the water-injection throttle full open at the huge 15,000-acre Canyon Reef unit in Cogdell field.

The unit soon will add 15 new input wells to the present 27. It will also expand water-injection facilities to handle 50,000 bbl. daily, about double the present input rate.

Unit members think the flood will recover about 60,000,000 bbl. of added oil from the Canyon Reef pay.

Early signs indicate the project is working well. First water was injected into the reef late last April. By June 21 former producers around the edge of the field were taking water. Six more inputs were added in December. The input rate last month had climbed to about 25,000 bbl. daily.

A former field-wide gas-injection program was abandoned in August 1955 after 2½ years, in favor of a crestal injection plan. Five input wells are pumping all produced gas into the crest of the structure.

It's too early yet to see much in the way of higher production. But the average gas-oil ratio has been falling steadily.

The plunge in reservoir pressure is being halted and reversed. Pressure originally was 3,120 psi. By last September it had fallen to 1,254 psi. The volume of water and gas now going into the Canyon, however, exceeds the volume of fluid being produced. Pressure is expected to show an increase at the next survey.

One of the big ones . . . Cogdell Unit takes in 377 wells, 345 of them producers. The field straddles the line between Kent and Scurry counties.

Texaco and other unit members feel the pressure-maintenance project in the field will hike its oil output from a primary figure of 135,000,000 bbl. to a new total of 195,000,000 bbl.

Other firms in the unit are Stanolind Oil & Gas Co., Chapman-McFarlan Producing Co., D. D. Feldman Oil & Gas Co., and Humble Oil & Refining Co. Unit participation is based on ability of the wells to produce and on net pay.

Chain complete . . . Cogdell was the last link in a chain of unit pressure-maintenance projects in the prolific Canyon Reef pay extending from south to north through Scurry and well into Kent County.

The units are the Sharon Ridge Canyon, the Diamond "M," the huge SACROC in Kelly-Snyder, and Cogdell.

They take in more than 80,000 acres and 2,500 producing wells. And they will recover more than a billion barrels of oil over and above primary production.

The bulk of this added oil, and of the wells and acres, too, is claimed by the mammoth SACROC project. The SACROC figures: 795,000,000 bbl. of secondary oil and 1,238 wells on more than 50,000 acres.

Farther to the north in Kent County, still another Canyon Reef flood is functioning in Salt Creek field.

This one has 109 wells on 8,850 acres. Injection of water and gas in the northwest end has hiked the ability to produce, without loss of pressure, from 13,856 to 21,000 bbl. daily.

Deep Pay Excites East Texas

CORSICANA.—East Texas may be in store for a new flurry of deep exploration in the midst of old, shallower production.

The Texas Co. has added a new link to the chain of Smackover discoveries which stretches along a 200-mile arc from Mexia to Texarkana (see map).

The 1 Edens in central Navarro County was completed for 6,500 M.c.f. of gas per day, with 33 bbl. of 61°-gravity condensate per million cubic feet.

Perforations were at 8,730-70 and 8,868-8,900 ft. Gage was through open tubing under pressure of 2,950 psi.

What it means . . . The discovery is relatively small in amount of production.

It's importance lies in its location on the erratic Jurassic-Smackover trend, which has been promising but frustrating to those in search of new, deep "big oil" in East Texas.

Five other strikes have been made along this trend so far:

. . . The most recent was Humble Oil & Refining Co.'s Smackover discovery in the old Mexia field in Limestone County. This is in the southern part of the trend—30 miles south of the 1 Edens.

It came in at 8,565 ft. in 1955, but after producing 12,913 bbl. of oil it went off production in April 1956.

. . . New Hope field in Franklin County found sweet gas and condensate at 12,000 ft. Tidewater Oil Co. has had good luck in the field and is currently drilling two more deep tests.

. . . Ginger field in Rains County had gas and condensate at 12,000 ft., and the discovery made heavy flows. But sulfur content was high, holding up successful development.

. . . Flower Acres field in Bowie County, northeastern Texas, was a small gas-condensate well, but it was a disappointment also. Another discovery at nearby Eylau was offset by four dry holes.

Shallow production . . . Texaco's Edens is on the northern flank of Powell field, right in the center of Texas' oldest producing area. The Corsicana-Powell fields have produced more than 150,000,000 bbl. of oil since 1896.

Production is from the shallow Navarro-Taylor and Woodbine sands of Upper Cretaceous age. A few wells in this area have penetrated below the Cretaceous.

Oklahoma Record Shattered

OKLAHOMA CITY. — Oklahoma has a new record-depth producer. British-American Oil Producing Co.'s 1 Reed came in at 15,575-15,645 ft. in the third Bromide-Ordovician sands of Grady County's Knox pool.

The well confirms the previous record holder, 2 Harrison, which was completed last year for 175,000 M.c.f. of gas and 26,075 bbl. of distillate per day from open hole in the third Bromide at 15,250-15,310 ft.

Pollution Law Cited

Court action could follow, Arkansas producers told

WASHINGTON.—The federal Government warned the oil industry last week that pollution of interstate waters must stop.

Secretary of Health, Education, and Welfare Marion B. Folsom took the first federal action under the new water-pollution control law recently passed by Congress. He served notice on a group of Arkansas producers to stop discharging well wastes into the Corney Creek drainage system within 90 days.

If the producers fail to take action, the department can go to court to force them to do so, HEW officials said.

The order was in the form of a recommendation from a special board which held hearings at Homer, La., last month. It went to the McAlester Fuel Co., Magnolia, Ark.; Williams, Sellers & Ewing, Shreveport, La.; and E. G. Bradham & C. B. Ragsdale and E. G. Bradham & D. E. Bradham, El Dorado, Ark.

The special board, set up by the surgeon general, found that the well discharges were contaminating the Corney drainage system, which runs into Louisiana. It recommended that the operators be required to install a collection and injection system to keep wastes out of the interstate waters.

Something new:

Home-heating oil to cool things off, too

NEW YORK.—Cool your house with oil? Now it can be done.

Servel, Inc., with the help of Gilbert & Barker Manufacturing Co. and Esso Research & Engineering Co., has introduced the oil-fired "Sun Valley" air-conditioning unit which will heat homes in winter and cool them in summer.

Using about ½ gal. of heating oil per hour, it will duplicate 3 tons of refrigeration. Heating capacity of 96,000 B.t.u.'s per hour requires about nine-tenths of a gallon per hour.

Burner input is changed by the flip of a switch. Units have been home-tested by Esso employes in Louisiana, New Jersey, and Massachusetts, and by Servel employes in Indiana.

Esso and affiliated Gilbarco developed the oil burner flexible enough to meet both the low requirements of the cooling cycle and high output needed to heat in winter.

Pipeline briefs

Shamrock Oil & Gas Corp., Amarillo, will build a 35-mile, 6-in. crude line to serve fields in Ochiltree and Hansford counties in the Texas Panhandle. The 30 leases in Farnsworth, North Cherokee, and Hitchland fields are producing 5,000 bbl. per day. The crude is being trucked to Phillips Petroleum Co.'s Kingsmill station. The new line, to be started in March or April, will tie in with Shamrock's system at the McKee station.

Southern California Gas Co. this year will spend $21 million on gas transmission lines, the largest single item in the utility's 1957 capital expenditures budget.

Most of the $21 million will go into the 244-mile, 30-in. line from Newhall to Needles. Southern Counties Gas Co. is a partner in the project. The balance of Southern California Gas' $44 million 1957 budget will go for expansion of underground storage facilities, customer service, and new equipment.

Carolina Pipeline Co. expects to begin construction of its tentatively authorized natural-gas system on June 1. Contract has been let to Panama-Williams Corp., Houston, for 177 miles of 2, 3, 4, 6, 8, and 10-in. between Blacksburg and Camden, S. C. Carolina Pipeline Co. has a Federal Power Commission examiner's approval to build the system and take 23,612,00 cu. ft. daily from Transcontinental Gas Pipe Line Corp.

Panama-Williams also is laying 13 miles of 7-in. for Humble Oil & Refining Co. crossing the Trinity River near Liberty, Tex., on the Gulf Coast. The contractor has completed 57 miles of 10-in. takeup and reconditioning of a Gulf Refining Co. crude line between Ranger and Roscoe, Tex. This is part of a system from West Texas to the Gulf Coast that is to be converted to raw products.

Pacific Northwest Pipeline Corp. is starting construction of its eight-story office building in Salt Lake City. The company, which moved its headquarters from Houston last year, has merged with El Paso Natural Gas Co. *(The Oil and Gas Journal, February 11, page 64.)* Pacific Northwest will be operated as a subsidiary of El Paso, retaining its own name.

Ben Franklin Refining Co. March 1 will acquire Service Pipe Line Co.'s Cotton County, Oklahoma, gathering system and the 8-in. line extending from Cache Creek eastward to Healdton. There the 100-mile system joins the Ben Franklin main gathering system which serves the company's Ardmore refinery.

Ben Franklin also is buying 10½ miles of 8-in. from Cherokee Pipe Line Co. between Cherokee's Hewitt station and Ringling, Okla. This line will be tied into the Cache Creek system, which handles 4,000 bbl. per day. Bell Oil & Gas Co., parent of Ben Franklin, will integrate its 8-in. crude line from Burkburnett, Tex., to Cotton County with the newly purchased system.

Trojan Construction Co., Oklahoma City, has 70 miles to go on its takeup of 276 miles of 8-in. crude line between Jacksboro and Mexia, Tex. The job is to be finished in 30 days. Trojan is straightening, beveling, and cleaning the old pipe. Almost all of it will be used by Sinclair elsewhere or sold. This dual 8-in. system has already been replaced by an 18-in. line with capacity of 105,000 bbl. daily.

Saskatchewan Power Corp. will construct a 14-mile, 4-in. line costing $225,000 to serve the town of Kerrobert. The lateral will be laid from its 14-in. Coleville-Biggar-Saskatoon main line this spring or summer.

Also for Pipeliners . . .

Jersey Standard's Rathbone tells how his organization moved to get more oil to the Gulf Coast and then to Europe (P. 104) . . . Texas Eastern's line from Mexico moves across Texas' famous San Jacinto Battleground area (P. 108) . . . Phillips attorney paints dim future for gas lines unless producers get incentive to drill (P. 109) . . . Three of five companies exploring in Sahara Desert in Algeria are enthusiastic about laying a crude line north from the producing area. Two routes are being studied for the line (P. 118).

PLUS THESE TECHNICAL FEATURES: How to predict blend properties of crudes for mixing with light ends in a pipeline (P. 157) . . . and Pipeline Patrol's construction tables (P. 179).

INVENTORS Stanley Wilcox (standing) and Robert Baltosser add final touches as . . .

Gravity "Brain" Makes Debut

TULSA.—The latest development by Seismograph Service Corp. is on production.

It's the "optical analog gravity computer," which promises to open up a new field for fast gravity-meter interpretation. S.S.C. developed the new instrument with an eye on saving time and money in analyzing gravity data.

The computer was displayed last week when Seismograph formally opened its new $900,000 research and manufacturing center on the southeast edge of Tulsa.

Here's how the new tool relates gravity readings to probable formations:

It produces a synthetic gravity profile from geologic cross-sections. These cross-sections are simple drawings on transparent film. An ordinary drawing pencil is used to indicate geological formations. Degree of shade represents density of the simulated formations. When the cross-section is placed on the computer "window" the equivalent gravity response is displayed.

Until the company moved into its new plant, the computer was applied only on an experimental basis. Now, it's out of the experimental stage. Tests showed these advantages:

. . . **Terrain and topographic corrections** may be handled rapidly.

. . . **Gravity response** from a geologic section can be checked quickly.

. . . **A cross-section can be modified** easily with a school-boy eraser. Thus, the geologist saves time in obtaining a new profile for comparison with field data.

. . . **Average density** of any formation can be simulated with accuracy comparable to accepted concepts of geological density distribution.

. . . **Validity** of conventional interpretation of gravity data can be determined.

. . . **An unlimited variety** of gravity solutions from reasonable models can be obtained quickly.

The computer is applicable to both two and three-dimensional analysis.

For sale . . . Under a new company policy, this and other tools will be sold by Seismograph for the first time. Until now, the company had no sales department.

This is not the first time Seismograph has "become competitive" with itself.

Some years ago, when the company began helping oil firms set up their own geophysical departments, some people shook their heads. They wondered what it would do to the company's operations.

Rather than eliminate the need for Seismograph's service, the practice paid off. The company made closer ties with the clients.

History . . . Since Seismograph was founded in 1931, it has grown by leaps and bounds. Within 3 years, there were crews in Poland and Romania. This was Seismograph's entry into foreign operations.

Today, crews are busy in five continents and 22 countries. It is the largest seismic contractor in South America, with four crews in Brazil, five in Venezuela, and two in Colombia.

There are subsidiaries in those three countries, as well as Mexico, Canada, Bolivia, England, France, Italy, and Libya.

Navy Pushes Shale Research

DENVER.—The U. S. Navy is going to ask Congress for authority to reopen the oil-shale research plant at Rifle, but it is not interested in gasoline. What the Navy wants now is jet fuel.

Navy says it is well equipped with facts to back up its plea and that the plant could be reactivated at small cost. The Rifle plant was operated for 8 years by the Bureau of Mines before it was closed last year. Since then, Navy has held it on a standby basis.

Previously, research at the plant was concentrated on converting shale into gasoline at prices competitive with natural petroleum products. But Navy says it would in no way compete with private industry if the plant is reopened.

The first private shale venture is expected to go on "shakedown" in about a month. It is Union Oil Co.'s $7,000,000 pilot plant near Grand Valley, Colo. Union officials said last week that operations are going "better than expected."

Esso Buys Research Lab Site

FLORHAM PARK, N. J.—Esso Research & Engineering Co. is planning a big expansion of its research facilities. The company last week contracted to buy 650 acres here. The site was one of 80 considered by the company.

Esso plans initially to build three buildings with a total floor space of about 280,000 sq. ft. The Jersey Standard affiliate was forced to build in a new location. There is no room for expansion at the firm's laboratories at Linden, N. J., and at its Bayway refinery.

Tidelands Squeeze

California operators hard hit by lease moratorium, now fear high royalties might lead to development by state

LOS ANGELES.—California oil companies last week were wondering if they will still be interested in bidding on state tidelands after the legislature has acted on proposed changes in wildcat royalty rates.

There was some concern that concessions might be priced out of the market and the state put in the business of doing its own development.

Several companies likewise were puzzling over what to do with new offshore drilling departments set up in the expectation of obtaining submerged-lands leases. It now appears most will have little to do during the remainder of the year.

All leasing of state submerged lands—including even those where drainage may be occurring to adjacent private lands—has been halted while the legislature considers whether the state is getting its fair share.

The Cunningham-Shell act opening the tidelands to leasing and exploration was unanimously passed by the legislature in the 1955 session. But now certain assemblymen are seeking to change wildcat royalty from a flat 12½ per cent to a sliding scale beginning at 12½ per cent *(The Oil and Gas Journal, February 4, page 78)*.

How high the scale would go from there would depend on the state lands commission's appraisal of how much oil could be recovered from a particular lease—proved or wildcat.

Big royalty jump . . . Assemblyman Joe C. Shell of Los Angeles, the only oil man in the legislature, has said he expects royalties on wildcat leases to be raised from 12½ per cent to 16⅔ per cent during the current session, which ends in mid-June.

Speaking before the Pacific Coast spring meeting of the Petroleum Equipment Suppliers Association, Shell said this would affect only the bonus bid.

A certain group of legislators, headed by Assemblyman Allen Miller, however, is seeking to raise rates so high that oil companies will be priced out of the market, Shell declared.

He pointed out that the group is already on record as favoring the state conducting its own exploration. Thus it would be only one more step for California to undertake development of its tidelands, he said.

In discussing the commission's complaint that it has had difficulty in determining whether a proposed lease should be offered as proved or wildcat acreage, Shell pointed out that the federal Government, Texas, and Louisiana have been doing this for years. They have had no difficulty in reaching such decisions, he declared.

Effect of the leasing moratorium declared by the commission is that development of California tidelands will probably be set back about a year. Seismic and core drilling will continue, but there are few leases where exploratory or development drilling can be carried out.

Companies hard hit . . . This will be a costly delay for the large oil companies. Drilling contractors and shipbuilders will be hurt, too. The latter two groups, along with labor organizations, earlier had urged the commission to speed up leasing because of unemployment in those fields.

Offshore Constructors, Inc., formed last year to provide California operators with gulf-type drilling platforms, was among the first to feel the moratorium. It canceled plans for a second DeLong platform and reduced its staff to almost nothing. Healy-Tibbitts Construction Co., a partner in the firm, will carry on Offshore's business during the lull.

The C.U.S.S. group of companies (Continental-Union-Shell-Superior) was possibly the hardest hit of the West Coast companies.

A sizable offshore department had been set up. Late last year it outfitted a floating barge with a 95-ft. derrick and equipment for drilling exploratory holes to 12,000 ft. or deeper, but the group has not been awarded a lease so its activities must be confined to exploration on unleased lands.

Cyclone Saves Time, Cuts Costs

OKLAHOMA CITY.—Use of drilling-mud cyclone centrifuges is starting to expand in the Mid-Continent area. Both operators and drilling contractors are being helped by such results as: increased bit life, decreased time per hole, less pump maintenance cost, and lower mud costs.

The recent quarterly meeting of the A.P.I. Mid-Continent District Study Committee on Drilling Fluids at Oklahoma City brought out these facts.

Desanding muds with cyclones was the topic. A discussion panel of Bob True, Big Chief Drilling Co., Oklahoma City; Don Weishaupt, Helmerich & Payne, Oklahoma City; John Atwood, Warren-Bradshaw Drilling Co., Tulsa; and Marvin Blubaugh, Magnet Cove Barium Corp., Chickasha, Okla., provided most of the field information. But others also contributed.

Savings have resulted from cyclone use wherever sand and shale are drilled. Centrifuging mud in deeper wells has probably shown the most benefit. Considerable amounts of mud chemicals can be saved by eliminating drilled shale which tends to make mud. Cleaning the mud of sand reduces equipment and bit wear; fewer bits are used; trip time is lowered; and hole time is cut.

Keeping mud weight low . . . Most applications of the cyclones in the Mid-Continent areas have been on muds of low weight. Keeping mud weight low is frequently the objective. Cyclones have been able to shave from 0.2 to 0.5 lb. per gal. from such muds consistently. Sand content can be kept below 0.2 per cent. No noticeable increases in drilling rates have resulted from the lower mud weights.

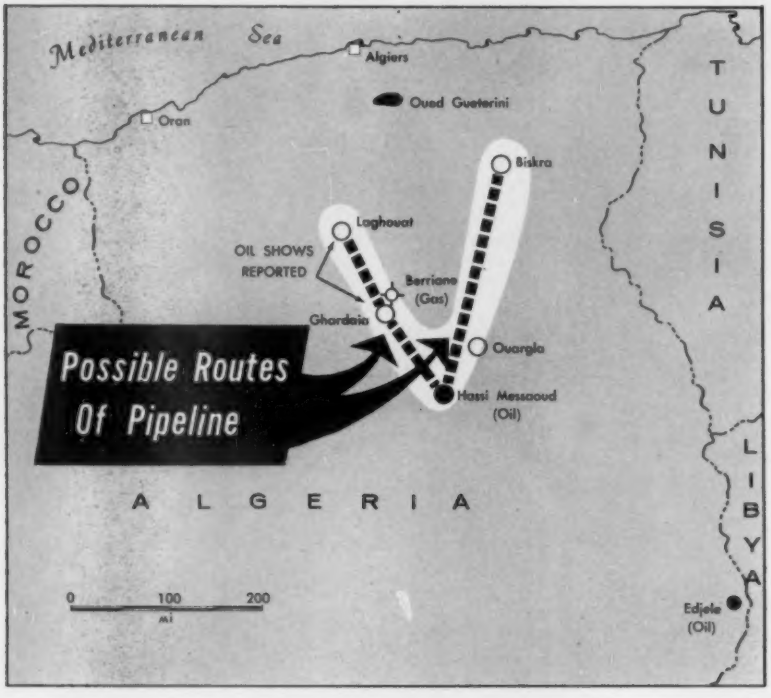
Keeping mud weight low has helped reduce loss of circulation in some areas. When lost-circulation materials are contained in the mud and the shale shaker is bypassed, the cyclones prevent weight buildup. A large part of materials such as walnut hulls, mica, and cellophane is retained in the mud when it passes through the cyclone. That rejected with the sand and cuttings is usually no greater than that lost by pit jetting.

Cyclone mud treating has not benefited all areas, however. It is particularly marginal where little sand is encountered in drilling. One such area is the Panhandles of Texas and Oklahoma. Here formations are mostly shale with limestone. Little savings in bits and pump repairs have been experienced here.

Lowered mud weight to combat loss of circulation and savings in water for mud have been credits, though.

Costs of operating cyclone units are ranging from $30 to $35 per day which includes depreciation of the equipment. A 30 to 50-hp. pump to feed the cyclones is usually included.

Some contractors have bought their own units and provide them at this rate. In other cases, operators have asked that the cost of the cyclone equipment be included in the drilling bid.



Sahara Line Talked

Desert successes also spark stepped-up exploration and drilling programs of firms operating in Algeria, Libya

SPURRED by two widely separated discoveries and oil shows at two other locations, French companies looking for oil in the Sahara Desert region of Algeria are talking a pipeline.

Armand Colot, managing director of Ste. Nationale de Recherche et d'Exploitation des Petroles en Algerie (SN Repal), says the pipeline is under study.

The two discoveries which stirred up most of the excitement could be producing 180,000 bbl. daily by 1960, according to estimates released by the French Government's Petroleum Research Bureau. Hassi Messaoud field, more than 500 miles south of Algiers would account for 100,000 bbl. of this and Edjele field, near the Libyan border, would account for 80,000 bbl.

Colot's enthusiasm is shared by at least two more of the four companies operating in the desert. Here's how the activity shapes up for this year:

. . . SN Repal will drill at least six more wells. Presumably, all will be in the general area where the company made the major discovery at Hassi Messaoud that brought on the pipeline discussion. Colot says also that extensive geological work will be continued.

. . . Cie. Francaise de Petrole Algerie plans to double its current activity in the Sahara region. The Algerian subsidiary of France's biggest oil company is doubling its capitalization to carry out the project.

. . . Cie. de Recherches et d'Exploitation de Petrole au Sahara (C.R.E.P.S.) has made no policy statement, possibly because it is busy drilling. C.R.E.P.S., a joint French-Shell company, made the desert's first oil discovery. It is rapidly developing a shallow field that is still shut in because of no pipeline outlet.

The pipeline . . . The SN Repal director said in Algiers last week that two routes are being considered for a pipeline to move Hassi Messaoud oil. One would move northwest to Laghouat and a railhead. This would cover about 200 miles.

The second route would be north and slightly to the east of another rail point at Biskra, a distance of about 260 miles.

The first, and shorter, route, would pass through an area where other recent shows have been encountered. There are only fragmentary reports, but apparently C.F.P. (A) has encountered oil shows at about 8,200 ft. near Laghouat.

Similar shows have apparently been found in a SN Repal well in the Ghardaia area. Both were found in alternate limestone and sandstone strata, and at about the same depth range.

At Berriane, where SN Repal started a well a year ago, a high-pressure, wet gas was found in a thick sand section.

One route of the pipeline would pass through this entire area on its way to the railhead at Laghouat.

Hassi Messaoud . . . Discussing the desert discovery last week, Colot was hesitant to estimate the find's potential. He did say the field could produce from 8,500 to 10,500 bbl. daily by 1958. Engineers of his company have previously said the single discovery well will produce from 1,800 to 2,500 bbl. daily *(The Oil and Gas Journal, December 31, 1956, page 104)*.

The discovery is about 63 miles southwest of Ouargla and about 16 miles from a 11,899-ft. dry hole the company drilled in 1955. The test encountered a sandstone pay section 450 ft. thick at about 11,500 ft. The French describe the crude as sulfur-free and "of excellent quality."

Edjele . . . About 390 miles to the southeast, C.R.E.P.S. made its initial discovery just a year ago. Almost on the ill-defined border between Algeria and Libya's province of Fezzan, the well tested about 20 bbl. of oil an hour from 1,475 ft.

Since that discovery the French-Shell company has drilled four widely spaced wells. Three are 50-bbl.-an-hour producers scattered along a north-south axis 18 miles in length and an east-west axis 72 miles long.

The company is continuing its drilling in an airlift supply operation. The area is at least 700 air miles from Algiers in an uninhabited area of the desert. Immediately across the Libyan border, Esso Standard of Libya, Inc., and Libyan American Oil Co. (Texas Gulf Producing Co.) hold concessions.

Esso's geological crews are working in the region, avoiding the border area carefully. They want to bypass any possible dispute between Libya and Algeria on the location of the border. Esso's people believe the Edjele structure extends across the border and onto their concession.

Major Kuwait Field Confirmed

● London statement reveals company has four productive wells north of present production and near Iraqi border

IT's nice to be able to say you were right all the time, even if it takes 20 years to prove your point.

Last week Kuwait Oil Co., Ltd., could do just that. The jointly owned British-American company last week took the wraps off its drilling program in northern Kuwait—partially at least. What the company revealed is just what the industry has suspected for a year. Kuwait has another major oil field. This one stretches for at least 20 miles.

The company proved it was on the right track when it drilled its first well in Kuwait in 1936. That well was one of the only two dry holes the company has drilled in the little Persian Gulf kingdom. Kuwait Oil has completed four productive wells spread over a distance of at least 20 miles, a short distance south of the Kuwait-Iraq border. The fourth well is Bahrah No. 2. Bahrah No. 1, a short distance away, was the company's first dry hole in the country *(The Oil and Gas Journal, September 17, 1956, page 137)*.

Here is what Kuwait Oil revealed last week in London with regard to its drilling program during 1956:

... **Sabriya No. 1** is located 9 miles southeast of northern Kuwait discovery well 1 Raudhatain. It is 60 miles north of Kuwait's present productive area. It was bottomed at the end of December at 8,450 ft. with 7-in. casing cemented at 8,437 ft. This test is being deepened to explore the Zubair sands. The Zubair sands are productive 40 miles to the north in the Zubair field of Iraq. Wells in this field average 3,000 bbl. daily each from about 11,000 ft.

... **Bahrah No. 2** is 10½ miles south of Sabriya 1. It was bottomed at 8,488 ft. with 7-in. casing cemented at 7,798 ft. The well is shut in.

... **Raudhatain No. 2** is 1.8 miles from the discovery well and is some 20 miles to the north of the Bahrah test. It was drilled after the discovery more than a year ago to determine the extent of the structure and the value of the discovery. Raudhatain No. 2 was bottomed at 9,695 ft. with 7-in. casing cemented at 8,778 ft.

... **Raudhatain 1,** the discovery, was for many months a "tight hole." Neither Kuwait Oil nor its parent companies would comment on the discovery while the oil industry rumors became more fantastic almost daily. Neither Gulf Oil Corp. nor British Petroleum Co., Ltd., has ever confirmed or denied the report that the discovery encountered pay sands 1,500 ft. thick *(The Oil and Gas Journal, January 30, 1956, page 136)*.

The company now has two rigs active in the area. The official Kuwait Oil Co. statement made in London said merely that the wells are closed in because producing facilities are not available in northern Kuwait.

In southern Kuwait, the company has two major fields, Magwa Ahmadi and Burgan. These fields, with 137 wells between them, were producing 1,200,000 bbl. daily before the Suez Canal shutdown caused a sharp cutback in production.

Dead end:

Italians Learn About Canal the Hard Way

A 1,900-TON tanker tried to take honors as the first commercial ship to travel the Suez Canal since its closing—but it didn't make it.

The Italian tanker, Pianeta, under Egyptian charter, sailed south from Port Said along with two Egyptian mine sweepers. Forty-nine miles down-canal, however, the sunken L.S.T. Akka blocked further progress.

Salvage crews were attempting to tow the Akka into Great Bitter Lake last week, where the wreck can be hauled away from shipping lanes. After the Akka is moved, a sunken dredger, Edgar Bonnet, will continue to block passage.

The Pianeta remained stalled. Salvage crews said, in effect: We told you so.

French Award to Feldman

D. D. Feldman, Dallas independent, has obtained an interest in a 710,000-acre concession in the Marseille-Bordeaux area of southeastern France.

The French Government awarded the acreage jointly to Transworld Petroleum Co. and Ste. de Prospection et Exploitations Petrolieres en Alsace (Prena). Feldman owns Transworld, which received a 49 per cent interest in the area. Prena is owned by banks and the French Government. It obtained the remaining 51 per cent.

Feldman's interest in French exploration is the third foreign concession arrangement he has tied down in little more than a year.

Air Mapping Starts

Survey will set boundaries of Guatemalan concessions

AN aerial magnetometer survey of 15,440 sq. miles of unmapped jungles is under way to establish concession boundaries in the Peten area of Guatemala.

Flights are being carried out by Aero Service Corp. for 15 oil companies holding concessions in Guatemala. Field work will last about 4 months. Data should be compiled by October.

The airborne magnetometers are being flown at about 1,200 ft. above the ground. Individual flight lines are spaced at intervals of 2 km. Shoran "fixes" are guiding the flights and providing 200 control points as a network for ground surveys.

The Guatemalan Government is accepting the Shoran technique as a basis for locations of concessions. The job marks the first time Shoran has been used as a guide on this type of project.

Cooperating agents for the government are Dirreccion General de Cartografia and Inter-American Geodetic Survey. Magnetic data for many of the participating companies is being analyzed by Gravity Meter Exploration of Houston.

Participating companies . . . Backing the project are Esso Standard (Guatemala) Inc.; Guatemalan Atlantic Corp.; Tidewater Guatemala, Ltd.; Sohio Caribbean Co.; Continental Oil Co. of Guatemala; The Ohio Oil Co. of Guatemala; Amerada Petroleum Corp. of Guatemala; Sun Production Co.

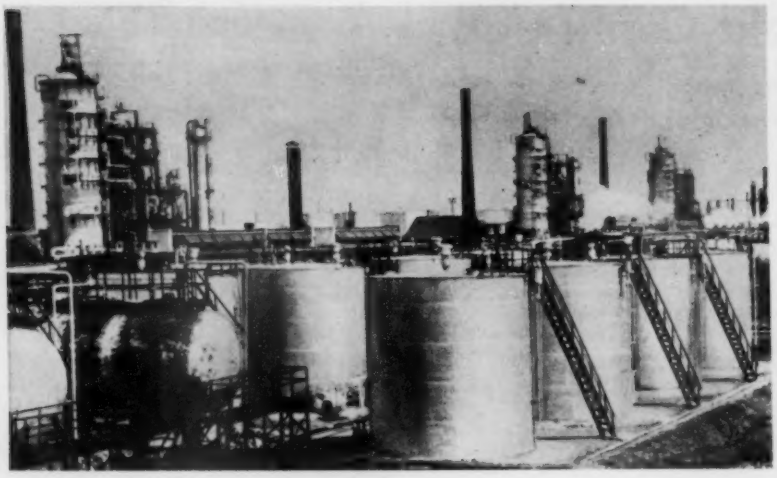
Texas Petroleum Co.; Petroleum Investments (Overseas) Ltd.; Cía. Petrolera California, Ltd.; Union Oil Co. of California; Signal Exploration Co.; Petroleas Guatemaltecos S.A.; and Husky Oil Co.

Pauley Insures Against Grab

Investments in oil exploration abroad are now eligible for guarantees against expropriation.

The International Cooperation Administration recently insured an estimated $6-million investment in exploration in Jordan by Edwin W. Pauley of Los Angeles. Pauley obtained an agreement giving him rights to explore and drill for oil and gas in about one-third of the 37,000-sq. mile country.

The guaranty is the first to be made to protect U. S. investments in foreign exploration and drilling. It is also the first insurance issued on investments in Jordan.



Refinery at Omsk a highlight:

Soviet Oil Is on the Upswing

RUSSIAN oil production is outstripping the goal set up by Soviet economic experts when they launched the U.S.S.R.'s Sixth Five-Year Plan in January 1956.

The country seems certain to exceed its 1960 petroleum-output goal of 1 billion barrels if the pace continues. And there is every indication that it will. While the target for other basic industries has been reduced, production of crude and natural gas has been on the upswing.

Members of the Supreme Soviet were told in Moscow this month that 1957 industrial expansion would be considerably less than in other postwar years. This was interpreted by some Western observers to mean the current 5-year plan has been pretty well junked.

But goals for the Communist oil industry were untouched. Crude output is slated to reach 1,940,000 bbl. daily, an increase of 16 per cent over 1956. Natural-gas output is scheduled to average 745,000 M.c.f. daily this year, a gain of 57 per cent.

According to the U.S.S.R. Council of Ministers' Central Statistical Administration, oil production totaled 624.6 million barrels last year, up 18 per cent over the 527.7 million barrels reported for 1955.

The increase of 96.9 million barrels was the largest annual gain in Russian oil history. The next largest annual gain was 85.7 million barrels in 1955.

New refinery . . . The Soviet Union last year placed its Siberian refinery at Omsk in large-scale operation. Work on the project is continuing.

Fed by new pipelines from the large Tuimaza fields west of the Ural Mountains, the Omsk installation will rival output of all the refineries in Baku, former center of Russia's oil industry.

The statistical administration also claimed that:

. . . Natural-gas production jumped 32 per cent last year, moving from 367.2 billion cubic feet in 1955 to 483.8 billion cubic feet in 1956. This also was a record gain for 1 year.

. . . Soviet refineries exceeded output goals for gasoline, diesel fuel, and fuel oil.

. . . Oil-equipment production rose 1 per cent last year to 54,300 short tons.

. . . Construction outlays for oil installations went up 18 per cent to about $1.5 billion. This included building and modernization of refineries, pipeline laying, etc.

Some soft spots . . . Despite these major successes, however, the statistical administration admitted the Soviet oil industry's operations are still marked by serious deficiencies.

The 1 per cent gain in oil-equipment production during 1956 was considerably below plan. Refineries increased the percentage of light products obtained from crude, but the rise was not as much as had been hoped for, and gains in operational and exploratory drilling speeds lagged behind schedule.

The administration also charged that the oil ministry "underfulfilled its plan for mastering methods of drilling with electric drills and for using hydraulic fracturing."

It said there has been a lag "in utilization of high-frequency current to dehydrate oil at the fields and in employment of complex mechanization for drilling and derrick-erection work."

———World briefs

Koa Oil Co., Tokyo, has increased capacity of its Marifu operations to 35,700 bbl. per day for crude distillation and to 3,000 bbl. daily for cracking. Previously, crude charge was 25,000 bbl. and cracking 1,400 bbl.

Yemen Development Corp. is delaying work on its 40,000-sq.-mile concession in northern Yemen until the Middle East political picture clears up. The company is an American firm owned by George E. Allen and other interests. It entered Yemen in 1955. Last year it spent $400,000 in exploration.

Teikoku Oil Co. has brought in one of the best wells ever drilled in Japan's biggest field. The 138 Yabashi on initial tests flowed at the rate of 276 bbl. daily from 4,580 ft. The field supplies more than half of Japan's 6,000 bbl. daily output.

A West German refining company, Scholven-Chemie A.G., plans to increase the capacity of its Buer plant from 15,000 bbl. to 40,000 bbl. per calendar day. The refinery will be designed to produce 14,600 bbl. daily of fuel oil. Expansion will be completed in 2 years.

B.P. Exploration Co. will drill for natural gas in the Whitby district of the British midlands in a joint venture with Imperial Chemical Industries, Ltd. As a starter, B.P. is deepening a well on Robin Hood's Bay drilled several years ago in search of potash. The operation is separate from an exploration program the company is conducting for the Gas Council.

Standard-Vacuum Oil Co. has ordered two 13,950-ton shallow draft tankers from a shipbuilding firm in Hamburg, West Germany. The carriers will deliver products from Stanvac's Sungei Gerong refinery, near Palambang, Southern Sumatra, to ports in Southeast Asia. They will be placed in service early in 1961. The company now has more than 160,000 tons of capacity on order.

West Germany's Kiel field may be extended into the Baltic Sea. A successful directional well extending 755 ft. from the coastline has spurred interest in offshore development in an area where the water is only 3 ft. deep more than ½ mile from the coastline. The stepout, 15 Kiel, flowed 70 bbl. daily through 1/10-in. choke from 5,348 ft. If recent seismic surveys prove promising, a sizable drilling program might be in the making.

Today and tomorrow in-

PROCESS AUTOMATION

by G. L. Farrar
Engineering Editor

MEASUREMENT

•

CONTROL ACTION

•

STREAM ANALYZERS

•

AUTOMATIC LOGGERS

•

ELECTRONIC COMPUTERS

JOE hounded equipment vendors and the instrumentation people in his field-processing, refining, and petrochemical plants when most processes went on automatic control some years ago. He pored over instrumentation and automatic-control books and burned the midnight oil reading trade and scientific journals. Finally, he decided he had a good idea of just how an automatic-control system worked.

Lately, though, Joe's had to do some more studying, and he's again been quizzing equipment salesmen and his instrument men. He's heard such terms as stream analyzers, data loggers, and automatic computers used in connection with automatic control. He's really had to dig, because the information he wanted had to be gathered from many different places. Joe really would have saved time if somebody had bothered to show him how all these elements tie together.

That's what we've done here at The Oil and Gas Journal. We've talked to a number of people and searched the literature thoroughly to see how these new tools fit into the automatic-control system now, and how they will be incorporated in the future.

At the same time, we've reviewed briefly some of the fundamental concepts of automatic control—measurement, how controllers operate, and control-valve operation.

The simplified flow sheet on the next page shows how all the elements tie together:

. . . **Measurement** is taken care of by the primary measuring element. The measured impulse is transmitted both to the controller and to the automatic logging system.

. . . **Control action** is transmitted from the controller to the control valve, and from a master controller to other controllers.

. . . **Stream analyzers** make continuous analyses of plant streams and show a continuous record, to help the operator make control adjustments as needed. In a few cases the analyzer also acts as a controller. In the future, the analyzer will be used more and more to reset control points on other controllers.

. . . **Automatic loggers** automatically log all desired quantities on a regular log sheet. In addition, average hourly and daily flows and similar averaged quantities are computed and logged out at the proper times. There will probably be no appreciable trend to have feedback from loggers. Rather, logged information will be fed to the electronic computer for further calculation.

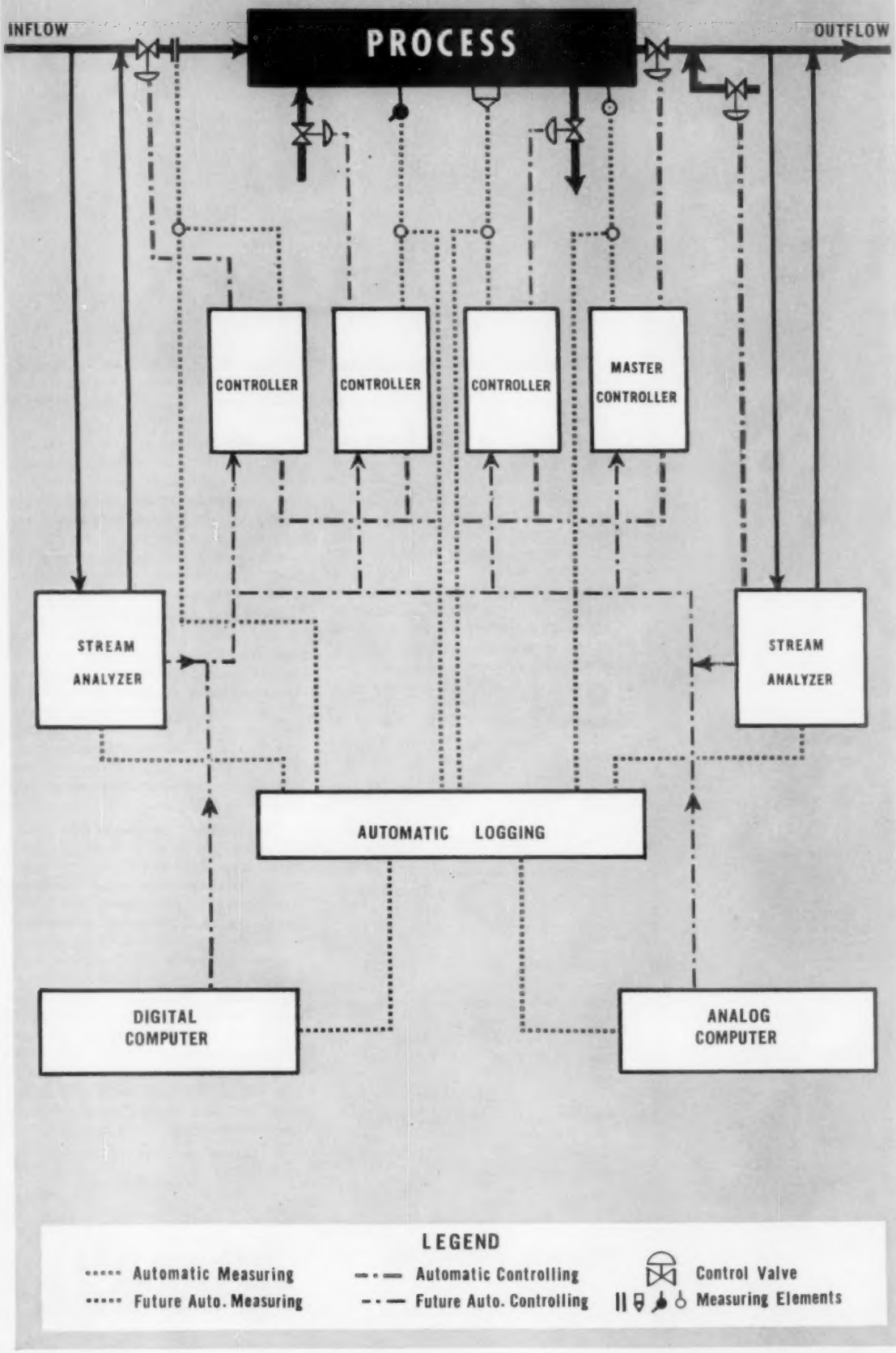
. . . **Electronic computers** now operate on batch feeding with no feedback. One analog computer is now being installed which is fed automatically from a data logger, but there are no feedback provisions. It is feasible to provide feedback from analog computers, but it will be some time before this can be done with the digital units. Ultimately, both types of computers will be fed automatically, and both will provide feedback for the control system.

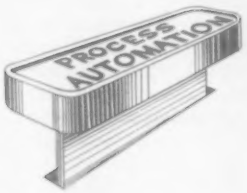
We hope this section gives you a little better idea how these new units work into the control system and how the control system itself operates.

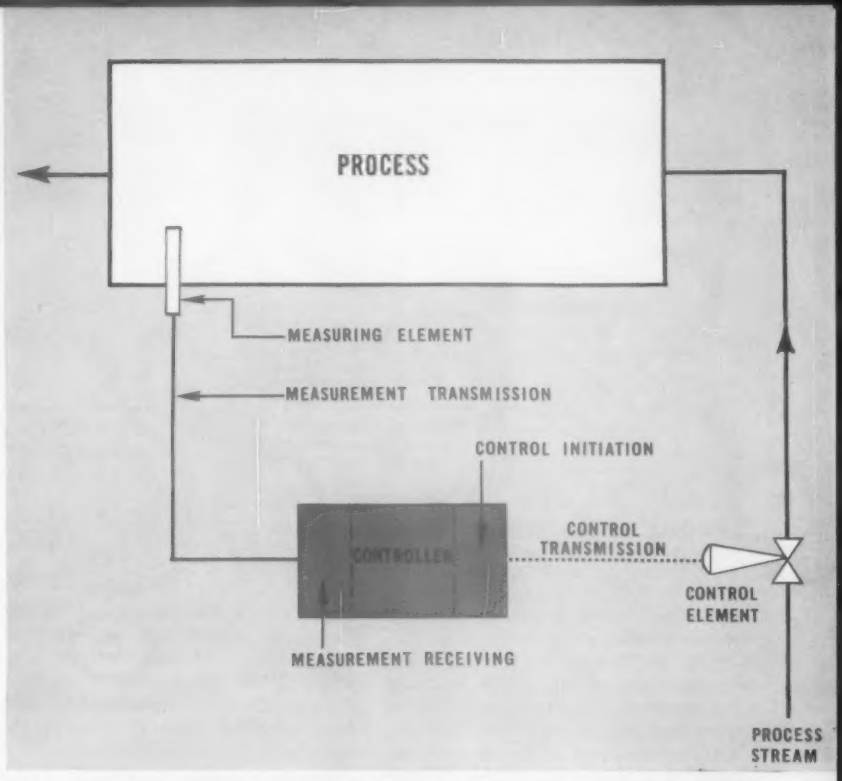
A limited number of reprints is available.

A SPECIAL FEATURE PRESENTED BY the OIL AND GAS JOURNAL

AUTOMATION IN PROCESS CONTROL







THE AUTOMATIC CONTROL SYSTEM and its three component parts. These are measuring means, controller, and final control element. Fig. 1.

AUTOMATIC PROCESS CONTROL . . . How and Why

AUTOMATIC control systems are based on detection of variations in several physical quantities which affect process operation. The most important of these process variables are temperature, pressure, flow, and liquid level.

The measuring system is one of the most important parts of the control setup. As shown in Fig. 1, this system includes measuring element, measurement transmission, and measurement acceptance at the controller. If an incorrect measurement is transmitted to the controller, the controller obviously has no chance to make the proper correction to assure good control. It is important, therefore, that the measuring means be selected carefully, and that careful study be given to its location in the process.

The principle of operation of a measuring element may be either electric or pneumatic. Generally speaking, satisfactory devices may be obtained which will operate on either principle, in any given measurement problem.

Element response . . . This is one of the most important considerations in the design of the measurement system. The value of the controlled variable indicated by the measuring element is not what the present level of the variable is, but what it was. The magnitude of this time lag is very important; if it is excessive, chances for successful application of automatic control are small.

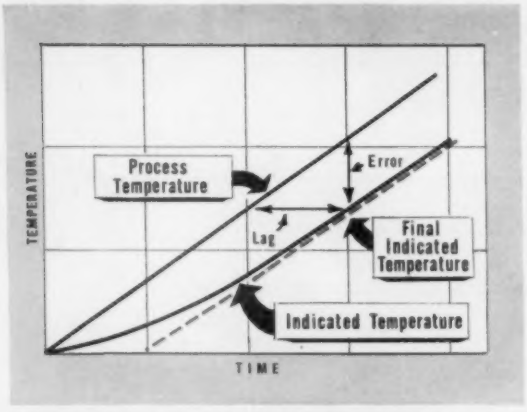
Due to the nature of heat transfer, the time lag in temperature measurement is larger than in measurement of other variables. As a result, lag is a more important consideration for this measurement. The response of a temperature - measuring element to a change in process temperature is shown in Fig. 2. At the start of the change, the measuring element will be indicating the correct temperature, if the process temperature has not changed for a period of time. As the temperature changes, the error increases until it reaches the maximum value, defined by the dotted line in Fig. 2.

Of course, most changes will not be allowed to continue uncorrected, because of controller action. If the measuring element has considerable lag, a cycling condition will result, as shown in Fig. 3. The amount of lag and the magnitude of the measuring error depend on the speed of response of the measuring element.

Time lags in measuring pressure, flow, and liquid level are usually small and have little effect on the quality of control.

Types of elements . . . Temperatures are measured by elements either of the pressure type or of the thermoelectric type. The pressure type is based on the change of pressure of a fluid in a contained system as temperature of that system changes.

There are three modifications of the pressure-element units; gas-filled, liquid-filled, and vapor-pressure elements. Selection of a particular one is based on the characteristics of the system. In general, the gas-filled and liquid-filled units have slower speeds of response, and the vapor-pressure unit works better for control of narrow temperature ranges, when the



RESPONSE OF TEMPERATURE-MEASURING element to a linear change in process temperature. Fig. 2.

controlled temperature is not near the ambient.

The thermocouple, the resistance element, and the radiation unit are the commonly applied thermoelectric units used in measuring temperature. The thermocouple is the most widely used. It is composed of two dissimilar wires, joined together at one end. An electrical potential which is proportional to temperature is generated at this junction.

The resistance element is based on the principle that the resistance of a wire changes with temperature.

The radiation unit focuses radiation from a heated body on a thermopile, several small thermocouples connected in series.

Both differential and area flowmeters are used for measuring flow. The differential meter is based on the principle that the pressure drop across a restriction in the line is proportional to the rate of flow, for a given material. This drop may be measured by a mercury manometer, diaphragm or bellows, differential-pressure cell, or other similar indicating and transmitting devices. The differential-pressure meter, particularly the mercury-manometer type, is used where high accuracy of measurement is required.

The area flowmeter operates with a suspended float in a tapered tube. The float is supported by the differential pressure across it. When flow rate increases, the float rises, thus exposing additional free cross-section for flow. The float remains suspended in a new position when differential pressure again balances it.

Float-type and differential-pressure-type units are used to measure liquid level. The differential-pressure unit operates in much the same manner as the same type of flowmeter, except that head rather than pressure drop actuates the measuring device.

Measurement transmission . . . The measuring element may be located at a considerable distance from the controller. If so, this portion of the system should receive considerable attention, to make sure that an undue amount of lag isn't introduced.

Special pressure boosters or transmitters may be required.

When using electric transmission, these limitations disappear. Speed of response is not reduced by the use of longer lead lines.

Other factors . . . When measurement is made for purposes of automatic control, **reproducibility** of measurement becomes much more important than absolute accuracy. For example, if a process operates well with the temperature control set at a certain point, it makes no real difference whether the actual temperature is 150° or 200° F. However, to have successful control, the measuring element must indicate the same thing each and every time the measured variable reaches a certain level.

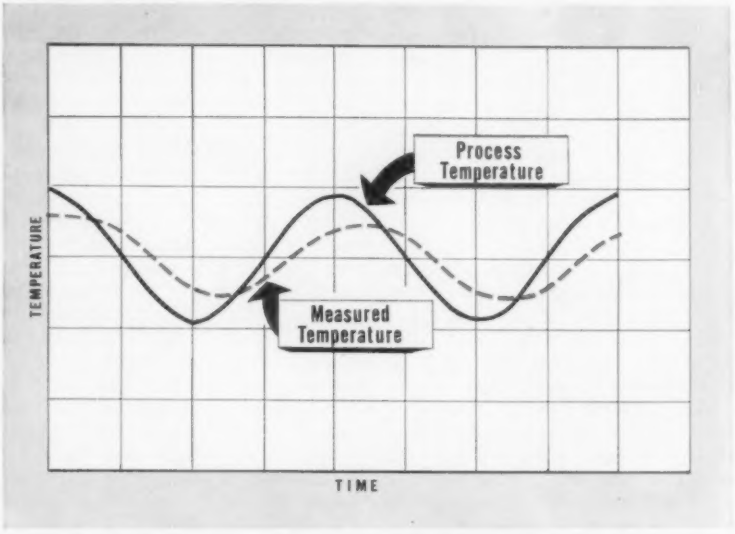
Sensitivity of measuring elements must be such that there is little measurement dead zone. Dead zone is the range through which the process variable can change, without that change being indicated by the measuring instrument. Dead zone is caused by such things as friction and lost motion in measuring elements that have moving parts.

Measurement dead zone is particularly insidious in the control system, because absolutely nothing is being done to counteract any change that may be occurring. This means that by the time the change is detected, it will have considerable momentum, and additional time will be required to return the variable to the control range.

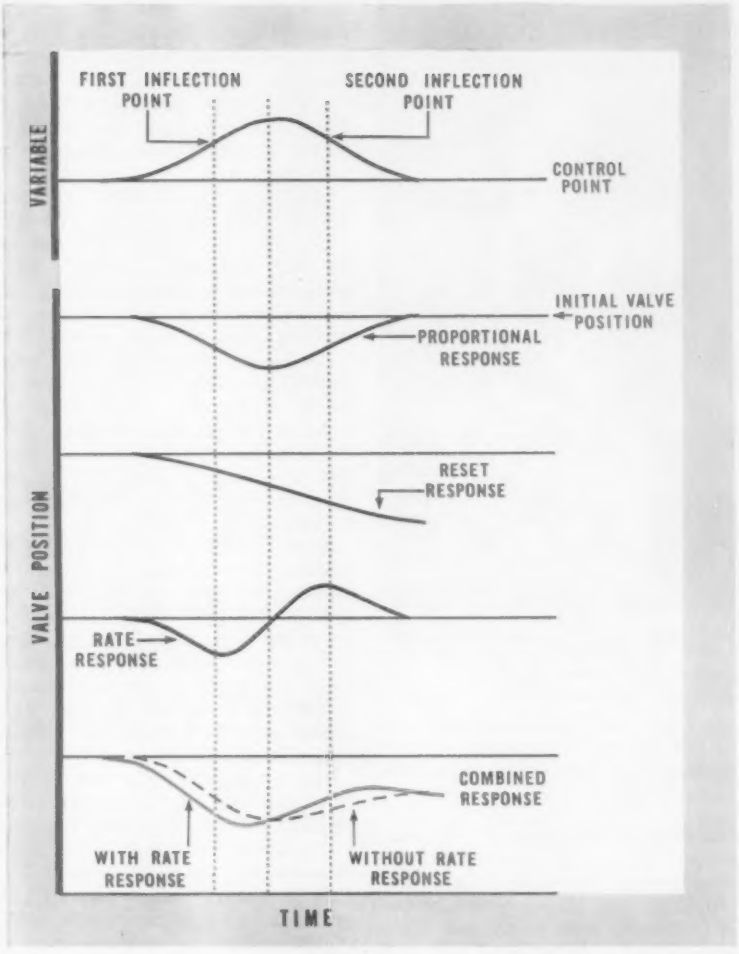
Automatic Controllers

The controller is the heart of the process control system. It takes the impulse sent to it by the measuring means, interprets this signal in terms of level of controlled variable and its relation to the desired control level, and transmits the proper signal for corrective action to the control valve.

The action of the controller may be quite simple, or it may be made up of corrective responses from two or three separate mechanisms. The choice of controller action is based on the characteristics and requirements of the process which must be controlled. Obviously, money is wasted when a better controller than is nec-



RESPONSE OF TEMPERATURE-MEASURING ELEMENT to a cycling change in process temperature. Fig. 3.



THE DIFFERENT TYPES OF CONTROL ACTION cause different valve changes for a given change in process variable. Here is a comparison of these responses. Fig. 4.

essary to do the required job is obtained.

Controller actions . . . The simplest type of controller utilizes on-off action. Either the control valve is completely open, or it is completely closed. This type of action results in cycling of the controlled variable, the amplitude of the cycle depending on the characteristics of the process itself.

This type of control makes no provision for load change. If more or less heat energy is required, the process will either heat or cool faster than originally. If more heat energy is required, it will cool faster and heat more slowly. This will lower the effective control point, but if the load change isn't too great the controller may still be able to do the job adequately.

Floating action . . . If more precise control is desired than can be obtained with the on-off controller, the control action of the controller is made up of one or more responses of different control components. Only one of these, floating action, can make up for a load change. There are several types of floating action. One responds to a change in level of controlled variable with a constant speed of valve travel.

Another changes speed of valve travel as deviation of controlled variable from control point successively reaches larger and larger values. This type of control has the advantage of providing faster corrective action for greater deviation of the variable, but it has a disadvantage, in that the transition from one valve speed to the next is not smooth.

This disadvantage is overcome by using proportional-speed-floating action. The **speed** of valve movement is proportional to the deviation of the controlled variable from the control point, and change in speed is continuous. This action, called **reset** when it is combined with other control actions, provides the best possible means for compensating completely for a load change in the process.

The control point may be maintained at its original value regardless of load change, as long as the capacity of the control valve itself isn't exceeded.

The speed of response of the floating mode must be slow to moderate, because the valve is reset to a different position when the variable is again at control point. This is shown in Fig. 4, which outlines the valve movement due to reset, or proprtional-speed-action, when load changes. Thus, instability of control and cycling result when change in valve setting is too great.

This characteristic, while essential for good control, leads to a disadvantage of the floating action. This type of control is not able to change the valve rapidly enough to prevent a comparatively long period of off-specification operation. Thus, another type of control action is needed to go with floating control.

Proportional response . . . The necessary control action to provide a rapid, proportional valve change with change in level of the controlled variable is known as proportional action. In this type of control, the **change in valve position** is proportional to the deviation of the controlled variable from the control point.

The response of this control action to a load change is shown in Fig. 4. Note that by its very nature this control functions only when the variable is away from control point. Once the variable is returned to control point, after a given load change or process upset, there is no net change in valve position due to proportional action.

The disadvantage of proportional control alone is that it is not possible to compensate for a load change. If the controller is adjusted to give a relatively large change in valve position for a given change in level of controlled variable, it is possible to approach the original control point after a small or moderate load change. But the original control point can never be reestablished.

Proportional and reset actions, then, work very well together. The proportional action prevents the deviation from control point from being excessively large or lasting too long. Reset action moves the valve to the necessary new position to compensate for a load change. The proportional-reset controller which utilizes these two complementary control actions has therefore became the workhorse of process control.

In some control applications, particularly control of temperature, considerable lag and dead time are introduced into the control system.

Rate response . . . Rate, or derivative, action may be incorporated into the controller to offset process lag and dead time. As shown in Fig. 4, this type of control moves the valve in proportion to the **rate of change** of the variable. Thus, when the variable begins to deviate, rate action moves the valve to compensate.

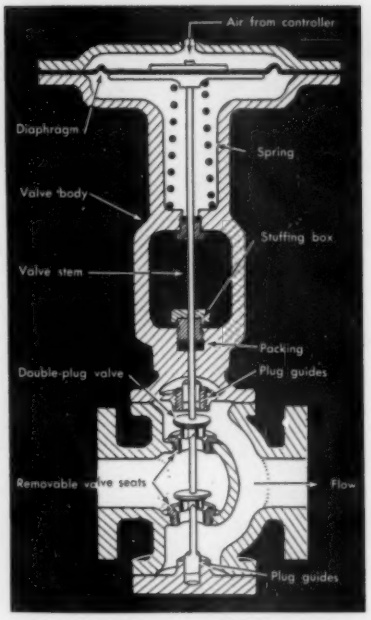
The maximum amount of valve travel is reached at a point corresponding to the first inflection point on the variable curve. Then, since the **rate of change** has become negative, rate action begins to move the valve in the opposite direction. This occurs before the variable reaches its maximum deviation but it occurs because the corrective action is already beginning to make itself felt.

Note that when variable has reached the point of greatest deviation, net valve change due to rate action is zero (since rate of change of variable is zero at this point). However, rate of change of valve position is a maximum because the deviation is at its maximum value. When the controlled variable passes the point of maximum deviation and begins to approach the control point, rate action tends to move the valve in the **opposite direction** from that indicated to compensate for change in controlled variable.

Again, this serves to prevent overshoot as the variable approaches control point. Maximum change in valve position due to rate action again occurs at the second inflection point. And when the variable reaches control point, **net change** in valve position, due to rate action, is zero.

Rate action is never used alone in a controller. It could never be adjusted properly to give stable control, and it could not by its nature compensate for a load change.

Rate action, then, is in a sense anticipatory action because it moves to prevent overshoot in a manner that can't be duplicated by the other control actions. As a result, the effects of process lag and dead time are minimized. Often a more sensitive proportional action setting may be used, when rate action is utilized, without making the combined action unstable. Likewise, a faster reset rate may be utilized when rate action is incorporated into the controller, again without making action unstable.



THE PRECISION control valve is usually used as the control element in the automatic control system. Fig. 5.

Combination controllers . . . All controllers which make use of proportional, reset, and rate actions have provisions for changing sensitivities of the various types of control. These settings should be adjusted with due consideration for the interactions of the various types. The settings are usually arrived at by trial and error.

The bottom curves in Fig. 4 show valve positions as determined by combination controllers, in response to the load change as outlined. The solid curve shows proportional-reset-rate response, while the dotted curve is due to a proportional-reset controller. The responses for a given controller are additive.

Great care should be used in selecting the control responses of a process controller. As a starting point in making the selection, Table 1 gives a qualitative evaluation of the applicability of control responses.

Control Valves

Most final control elements used in oil-processing work are precision control valves. The precision valve is a variable orifice, with varying cross-section area and varying "K" factor. For this reason, good valve design is imperative, and good craftsmanship in the construction of the valve is very important.

A typical control valve is shown in Fig. 5. A double inner valve is used, to prevent unbalanced forces on the plug and stem. The two valve seats, as well as the double plug, are easily removable, so that they may be replaced when necessary or desirable.

The valve should never close completely, since metal-to-metal contact would change the orifice characteristics and make them irregular. For the valve to function properly, at least 50 per cent, and preferably 60 per cent, of the line pressure drop must be available at the valve.

Some control valves have a semilogarithmic flow response to linear increments of valve position. This response, obtained by appropriate shaping of the plug, assures that the valve will be open appreciably at all usual control positions. It also provides for a greater change in flow per unit change in valve position at the control position.

Other control valves have linear flow response with change in valve position. Advantages for this response are comparative simplicity of construction and better valve operation.

Most control valves presently in operation are pneumatically controlled, as in Fig. 5. Air pressure is transmitted from the controller to a diaphragm in the valve top. As pressure is increased on the diaphragm, the valve is moved in the direction of the applied force. A spring opposes this force, and the amount of valve movement is therefore proportional to the increase in air pressure. If air pressure is decreased, spring force moves the valve in the other direction.

The operation of the pneumatic valve is often unsatisfactory because of friction along the valve stem, poor diaphragm characteristics, and hysteresis in valve response. A valve positioner will correct these shortcomings

Electro-hydraulic valves are now available, to be used with all-electric control systems. These are proving satisfactory since they respond rapidly to the electric signals from the controller.

TABLE 1—APPLICABILITY OF CONTROL RESPONSES

Control response	Process behavior	Dead time	Load change
On-Off	Slow to change	Small	Slow and small
Proportional-speed-floating	Fast	Small	Slow to moderate
Proportional	Moderate	Moderate	Small
Proportional-reset	Any	Moderate	Slow
Proportional-rate	Moderate	Any	Small
Proportional-reset-rate	Any	Any	Any

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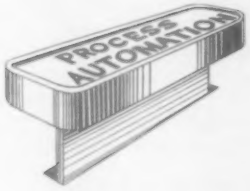
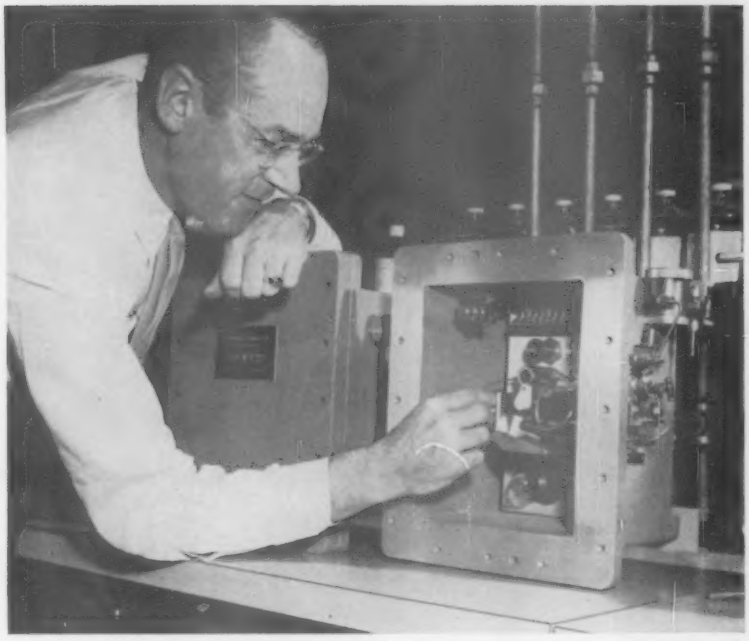


PROCESS STREAM ANALYZERS . . .



THIS ULTRAVIOLET ANALYZER is used in refineries and chemical plants. It was developed in the instrumentation laboratories of Shell Development Co.

". . . higher yield of higher-quality product"

STREAM analyzers can result in higher yields of high-quality product, increased throughput, and less off-specification material in petroleum-industry processes.

A process-stream analyzer provides continuous and automatic analysis of the stream, and cuts hours off the time required to obtain an analysis in the laboratory. The stream analyzer promises (1) to greatly improve operations that are "controlled by inference," and (2) to finally supersede inference control in many cases.

Control by inference means that under predetermined controlled conditions of temperature, pressure, and flow, it is inferred that product quality will be that desired.

Process changes . . . Obviously, control by inference cannot take into account such things as (1) change in feed composition, (2) accumulation of impurities in a recycle stream, or (3) change in catalyst activity.

The process-stream analyzer instantly detects basic process changes and permits the operator to take immediate corrective action.

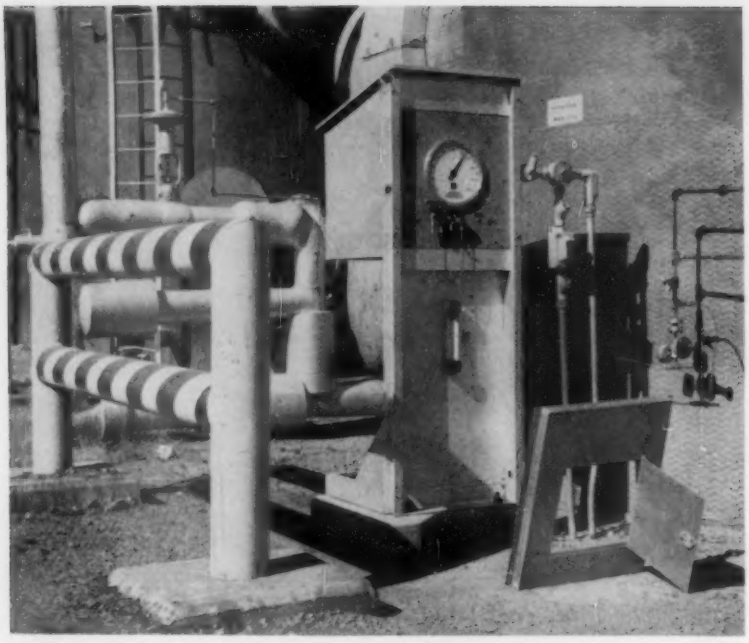
Continued improvement in analyzers is leading to their use as automatic controllers to change values of the process variables as needed for optimum operation.

Classes of analyzers . . . Process-stream analyzers are divided into two classes—physical and chemical. The principle of operation of the physical instrument is based on continuous measurement of a physical property of the controlled system. The chemical instrument is based on molecular structure or a chemical change in the controlled system.

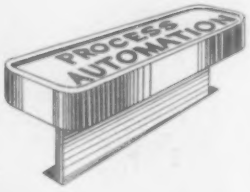
There are several analyzers available for use in oil and gas-processing plants and petrochemical operations. Here is a selected list, along with a brief description of the principle of operation and status of application of each.

Physical Instruments

- **Thermal conductivity.** This property of the process stream is compared with that of a sample of known composition. The change of resistance of heated electrical filaments is actually measured. The filament is surrounded by the gas sample, and a change in sample composition (conductivity) causes an immediate change of filament resistance. These instruments are used for both monitoring and control of liquid and gaseous streams.
- **Differential refractometer.** The refractive index of the process stream is compared with that of a known reference sample. The purity of the process stream is correlated on the basis of the deviation of the refractive index from that of the pure sample. Refractometers are used both for monitoring and control.
- **Viscosimeter.** The principle of operation for these instruments is that motion of a pulsating or rotating member is retarded in proportion to the viscosity of sample being tested. The instrument is calibrated against a standard solution. These instruments are being used for both monitoring and control.
- **Dielectric constant.** Dielectric constant of the process stream is measured continuously. Change in this quantity is proportional to change in



DIFFERENTIAL REFRACTOMETER ANALYZER installed in a processing plant of Phillips Petroleum Co. This instrument was developed in Phillips laboratories.



Many of the process-stream analyzers adapt to process control

composition of the stream. This instrument is used for monitoring, and there are planned control applications.

● **Hydrogen diffusion.** This instrument is based on the principle that hydrogen is easily diffusible through palladium. The stream containing hydrogen is passed over a palladium tube at a controlled given pressure. Hydrogen diffuses through the tube, and the resulting pressure inside the tube is an indication of the amount of hydrogen in the sample. This instrument is used for monitoring.

● **Hygrometer.** In this instrument all moisture is absorbed and electrolyzed. The amount of current required for electrolysis is a measurement of water present.

The instrument is used to monitor gas streams.

● **Colorimeter.** This instrument passes a beam of light through a flowing sample. The amount of light transmitted varies with color intensity or turbidity. It is used to monitor gas and liquid streams.

Chemical Instruments

● **Hydrogen ion.** Measurements are based on the hydrogen ion concentration (pH) of water solutions. The measuring electrode detects the difference in pH of two solutions, the process stream and a standard solution. These instruments are used both for monitoring and control.

● **Infrared.** When infrared radiation is passed through a mixture of gases or liquids, energy is absorbed in the wave lengths of the components and in proportion to the concentrations of these components.

Infrared instruments are used for monitoring both liquids and gases and for control of gaseous streams. Plans are being made for control of liquid streams.

The infrared process-stream analyzer is one of the most important monitoring tools. It may be used in separation, such as precise fractionations, solvent recovery, blending operations, and impurity buildup. In many cases the instrument can be used to determine specifically the presence of one component in the presence of many others.

● **Ultraviolet.** This instrument works on the same general principle as the infrared analyzer. It measures the absorption of ultraviolet radiation in the ultraviolet region. Ultraviolet instruments are used for monitoring and controlling gases, and applications are planned for monitoring and controlling liquids.

● **Mass spectrometer.** This instrument takes advantage of the fact that different molecules will ionize to give different masses. The sample is ionized and passed through a magnetic field. Ion paths are changed in inverse proportion to their masses, and ions of a given mass will collect at a given collector plate in the instrument.

The instrument is calibrated for the components in the mixture which is passed through it. The mass spectrometer is used for monitoring gases, and plans are being made to use it for monitoring liquids and controlling both liquids and gases.

● **Chromatography.** These instruments work on the principle of selective absorption of various components in a mixture as it is passed through a tube packed with solid adsorbent Plans are being made to monitor and control gases with these instruments.

● **Oxygen.** Analyzers for oxygen are based on either the magnetic or polarization principle. In the magnetic type, the sample is subjected to magnetic field. Oxygen is strongly paramagnetic; thus, the more oxygen in the sample, the greater the effect of the magnetic field. In the polarization type, oxygen combines with hydrogen and causes depolarization of an electrolytic cell.

Oxygen analyzers are in use for monitoring gaseous streams, and plans are being made for a control application.

● **Carbon dioxide.** The carbon dioxide analyzer is based on the absorption principle. The sample from the process stream is divided into two streams. The carbon dioxide is removed by absorption in the analyzer, and the resulting pressure differential between the two streams is an indication of the amount of carbon dioxide in the stream.

The carbon dioxide analyzer is used to monitor gas streams.

● **Sulfur.** Bromine is used in this instrument to oxidize the sulfur in

the entering sample. The bromine concentration is maintained at a constant value, and the amount of bromine added to replenish the supply is an indication of the sulfur concentration in the process stream.

The sulfur analyzer is used to monitor gas streams, and plans are under way for control applications.

● **Radiological.** This instrument is used to analyze binary gas mixtures, and particularly to determine the presence of inerts which build up in cyclic processes. Gas samples are ionized by beta particles, and the difference in ion currents between the process stream and a standard sample is an indication of the amount of another component in the stream.

This instrument is used to monitor gas streams.

Care in Application

The decision to use a continuous-analysis instrument on a process stream should not be made lightly. The application must be carefully worked out. A great deal of process information must be obtained and analyzed, to determine instrument characteristics and adjustments.

Initial cost for most stream analyzers is high, and samples must in many cases be carefully conditioned to be at proper temperature, pressure, moisture content, etc. Maintenance must be carried out by a competent instrument mechanic. Some analyzers require special utilities, such as distilled water, special gases, and constant-voltage power.

When stream analyzers are properly applied, exceedingly rapid payouts can be realized. An infrared analyzer was installed on the debutanizer overhead in an alkylation plant. By keeping the isobutane concentration to a minimum in this reject stream, the analyzer paid for itself in 6 months.

Other rapid payouts have ranged from 1 to 3 months.

Analyzer accessories . . . The process-stream analyzer has developed quite rapidly, and as a result, there are few standard systems to connect the analyzer into the control loop.

Nearly all of the stream analyzers are equipped with regular recorders when monitoring process streams. The infrared and ultraviolet absorption instruments may be obtained with automatic zero suppression and span standardization. When these automatic accessories are combined with controllers which utilize proportional, reset, and rate modes of control, the control setup has all the functions of an analog computer.

Programers are used with stream analyzers to enable the devices to be used on more than one application.

Process-stream analyzers can also be connected into the logging system when one is employed, and logged results can be put in proper form for use in a computer.

Sampling points . . . One of the most important things to be considered in the application and engineering of a process stream analyzer is the location of the sample points.

Sample points should be located away from low points in the process line, so that a clean, dry sample may be obtained.

The sample point should be chosen so that transfer lag is kept to a minimum.

Applying the Analyzer

It takes detailed study of a process scheme to decide where continuous-stream analyzers are needed. However, there are some general considerations to be followed in applying these instruments.

Feed streams may vary in composition, causing off-specification product in subsequent steps. The analyzer enables the operator to change temperatures, pressures, and flows to compensate for change in composition.

Recycle streams tend to have an increase in either inerts or undesirable components. The continuous analyzer can be applied to show the concentration of the material which experience has shown is most likely to build up during operations.

Reactor effluent streams change in composition as catalyst activity changes. An analyzer can sometimes be applied to detect this change in composition, so that temperature, pressure, and/or flow can be adjusted to compensate.

AUTOMATIC INFRARED ANALYZER in operation in a Phillips Petroleum Co. installation. This is one of the most versatile process-stream analyzers.

Continuous product-stream analysis will show immediately when off-specification product is obtained. Or, continuous analysis of a reject stream will give an immediate indication when product is being lost at this point.

Absorbers and scrubbers often have critical jobs to do in processing operations. A continuous analyzer will show immediately when one of these vessels fails to operate properly.

Consult the manufacturer . . . The manufacturer of the analyzer should be consulted in detail when purchasing and applying the instrument.

If possible, a manufacturer's representative should be called in to assist with the planning and installation.

Many analyzer installations call for multiple-point analysis, either on a fixed cycle or in conjunction with a scanner or logger. Here again, the manufacturer's representative can be of great assistance in specifying the proper equipment to insure successful operation.

Analyzers in control . . . Many of the process-stream analyzers are readily adaptable for process control. The instruments are most advantageous when used in cascade control. Here, they reset the control points on other controllers as is necessary to change process conditions.

This method of operations has several advantages. Stream analyzers as a class of instruments do not have the high on-stream factors that conventional controllers do. Thus, when the analyzer is not in operation, the control points of the other instruments are set manually by the operator, and process operations continue without any break.

Still another advantage of the cascade control system is that the temperature, pressure, and flow controllers can pick up physical variations more readily than can the analyzer.

Ultimately, the more complicated process systems may be engineered to have process-stream analyzers send information to computers, where the interrelationships of the various process variables are stored.

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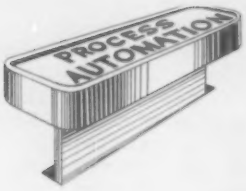
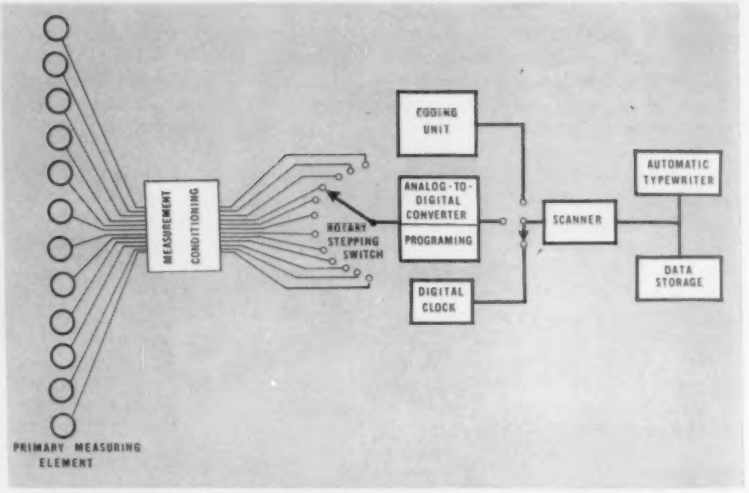


AUTOMATIC DATA HANDLING



COMPLETE PROCESS INFORMATION in digital form is furnished by the automatic data-handling system. The functions of the system extend from the primary measuring elements to typewriter printout. Fig. 1.

"... better process information during upsets"

THE modern oil-processing plant is quite complicated, and its operation requires the collection and application of large quantities of process data. The analysis of these data helps to determine the decisions of process operators, engineers, and management in operation analysis, scheduling and planning, and accounting control.

Measurements of variables such as pressure, flow, and temperature are made by means of primary measuring elements. Each measurement must then be converted into a form which can be interpreted and analyzed. Usually this involves conversion of an analog quantity into a digital quantity.

The pressure in a pneumatic-measurement system and the voltage generated by a thermocouple in an electrical-measurement system are examples of these analog quantities. Analog measurements are usually recorded or indicated on suitable instruments in the plant control room. And before these records can be used in calculations, they must be converted manually to the digital form.

This is a time-consuming, expensive, and inefficient process.

Automatic logging . . . Fully automatic logging systems which provide complete and accurate information in digital form are now available. The data are typed out on a log sheet by an electric typewriter, right in the control room. Most systems have provisions for automatic storage of data by means of punched cards or tape. And data may be transmitted readily from the control room to any desired location in the plant.

Logging systems as such do not presently contribute anything directly to automatic control. However, with an automatic logging system, the operator can spend his time more advantageously in watching the process. This often results in better operation and better control.

Equipment reliability . . . There have been reports that the logging installations which have been installed to date have not performed satisfactorily. There is some basis in fact for these reports. As is usual with new equipment, a number of changes in design, operation, and maintenance have been required, based on the results of plant experience.

But these changes have been made, and the service factor for one operating installation is about 99 per cent.

Engineers, operators, supervisors, and

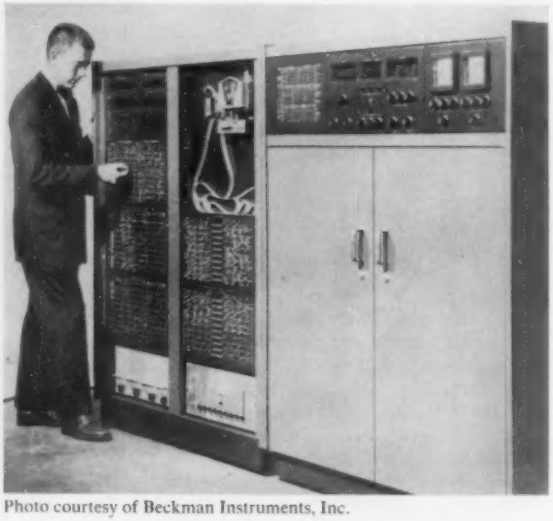


Photo courtesy of Beckman Instruments, Inc.

Thus, the unit is out of operation less than 8 hours per month.

It has been proved that refinery instrument personnel can service these units, provided they have adequate initial training, and provided they are assigned to the equipment on a continuous basis as maintenance and repair work are necessary.

Justification . . . It has been hard to economically justify an automatic logger for any except the most complicated processes. Most of the present installations and those planned for the near future have been made without promise of concrete payout. As more information about logger operation is collected, and as it becomes possible to evaluate the intangibles more exactly, it will be possible to determine payout times more accurately.

Perhaps the most positive value of the data logger is the **obtaining of accurate data during upsets and emergencies**, and obtaining this information on schedule. Many times, study of this detailed information has enabled the determination of the cause of the upset. In such instances, corrective measures can be taken, or more attention can be given to the source of trouble.

When manual logging of data is employed, the logging function is almost or entirely neglected during an upset, because the operators are busily trying to return the unit to normal operation. Thus, with manual logging, data are usually not available for the very times when they are most needed.

Recorded data are much more accurate when using the data logger. When the operator must copy many readings from gages or recorders, along with his other work, there is possibility for error every time he writes down a figure. Then, too, much time elapses while he is filling out the log sheet. It thus becomes impossible to know exactly when a certain reading was taken.

When using an automatic logger, the exact time is known. Most loggers have built-in equipment for periodic automatic checking of the system to make sure all components are working properly.

Labor saving is often mentioned as one of the ways of justifying an automatic logger. This saving ranges all the way from the operator to the accounting department. While it is usually not possible to run the unit with fewer operators, the operators do have more time to look for trends, spot possible upsets early, and in general give the process better supervision.

The engineers find their work much easier, in that the data are presented in logical, orderly fashion, and calculations can be started almost immediately, without having to mull over log sheets and thumb through recorder charts. Accounting-department computation is also reduced.

The plant supervisor finds it much easier to keep in close touch with the plant operations. He can pick off values of the key variables at the typewriter or off a completed log sheet in a fraction of the time required to get the same information from manually logged data, or from indicators and recorders in the control room.

Other reasons are also advanced in attempting to justify automatic loggers. Technical service groups always want more information than is readily available to evaluate certain phases of plant operation. The automatic logger can make more information available to these groups. Research groups need detailed information for over-all evaluations of processes. They, too, are benefited by the automatic logger.

The logger is a necessity when automatic computers are tied into plant operations on a routine basis.

It seems quite likely that the number of recording and indicating instruments required for a process can be reduced considerably, once the automatic logger has proved itself. However, there has been no significant trend in this direction thus far.

How Loggers Operate

A block diagram of an automatic data-handling system is shown in Fig. 1. As the logger is switched from point to point, the measuring circuit changes the input electric signal into a proportional rotating shaft position. The shaft position is then translated into digital output. The digital answer is automatically typed at the appropriate place on a log sheet.

Such things as column spacings, decimal points, and skipping unused points in the logger are taken care of in the programing of the unit.

Measuring system . . . The logger measuring system operates directly off the primary measuring means for the various variables. Some of the signals are electrical, and some are pneumatic. The pneumatic signals are converted to electric signals by means of transducers.

The transducer is a device for con-

the accounting department all find work easier with automatic logger

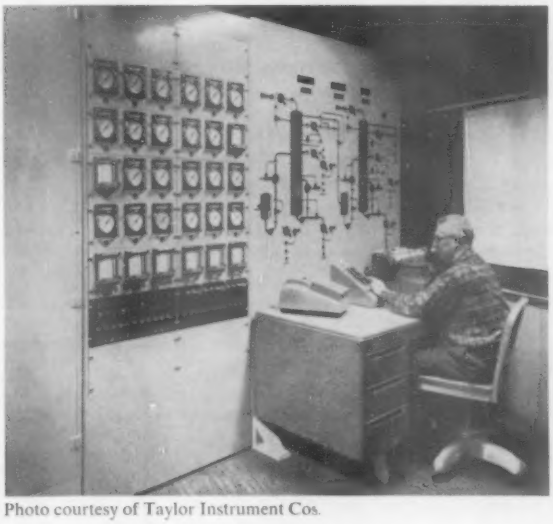


Photo courtesy of Taylor Instrument Cos.

Photo courtesy of Fischer & Porter Co.

Loggers will be especially valuable in pilot plants

verting one kind of physical phenomenon into another kind—in this case, the conversion of a pneumatic pressure into an electric signal. Usually this is done by allowing the pressure element to position a potentiometer. As pressure changes, the voltage output from the potentiometer is changed accordingly.

The flow transducer must provide some means of square-root extraction. This can be taken care of by including a square-root slide wire into the measurement-conditioning unit. The programer can then be set up to select this slide wire when a flow point is being logged.

The electrical signals from electrical measuring elements and from pressure and flow transducers can be fed to a null-balance potentiometer or a frequency counter. In the potentiometer, the input voltage is compared with a known slide-wire voltage. If there is unbalance, the slide wire is moved until the difference in voltage is zero.

The frequency counter gives more speed than the potentiometer, but there are several limitations. The small, nonlinear thermocouple voltages are hard to handle. Handling the square-root functions is also difficult.

Potentiometer output . . . The potentiometer produces a mechanical output in the form of slide-wire shaft movement. The angular position of the shaft after movement is proportional to the magnitude of the input voltage. When the input is nonlinear, suitable linearizing instruments are used.

The programer selects the appropriate slide wire and potentiometer bridge circuit for each variable. Digitizing is accomplished by connecting a digital converter directly to the shaft of the potentiometer. The converter converts the potentiometer shaft position into several separate indications, one for each digit of the number to be printed.

A 10-position switch may be used for each digit of the logged quantity. The contacts of each switch are numbered 0 to 9, and appropriate contact is made before the magnitude of the logged quantity is relayed to the readout typewriter. Once the appropriate digits are selected, the decimal output of the converter is translated into a code suitable for the operation of an electric typewriter.

The typewriter . . . The typewriter itself usually is a long-carriage electric typewriter. A log sheet is placed in the typewriter, and the sequence of operations is started. From the coding unit, information about the process unit, the shift, process condition, the operator, and similar is relayed to the typewriter and typed out on the log sheet. Then the time is obtained from the digital clock and printed on the log sheet.

In some logging units, provision is made for automatic standardization and checking of all the components before each logging cycle is started. Once this check is completed, the typewriter prints out an appropriate signal, and the unit is ready for logging.

A rotary stepping switch or similar device is used to move automatically from point to point in the logging cycle. Total time required for operations at each point is 2 to 3 seconds.

Abnormal values . . . During the logging operation, each variable is compared with the allowable high and low limits as set up by the programer. If the variable is outside the limits set for it, its value will be printed in red on the typewriter, and an alarm will sound. In some loggers, this particular variable will be connected into a recorder installed for that purpose, and the recorder will be automatically started.

This gives the operator a continuous record of the variable while it is outside the allowable limits. Meanwhile, the logger continues with its cycle.

Alarm detection is usually taken care of electronically. Input voltages from each variable are compared with the two reference voltages determined by the high and low limits. The detection system then detects any voltage outside these two limits. Off-specification voltage triggers a thyratron or similar electronic device.

Manual readout . . . Once the logging sequence is completed, the operator examines the recorded data. If he desires additional information about any part of the process, he may start another sequence, or he may obtain values of specific variables as desired.

There are a number of possibilities for totaling, integrating, and averaging daily quantities. These items are selected as desired, and the logger is set up for the typewriter to print them out at the end of the day. These summarizing figures are of great value to the engineers and to the accounting department.

Data storage . . . In addition to the data printout on the log sheet, provision is usually made for data storage on punched tape, magnetic units, or punched cards. This puts the operating results in the proper form for mechanized data-handling techniques, and goes a long way toward the step of automatically and directly feeding these data into an electronic computer.

Scanning . . . Automatic loggers are set up to scan the process during periods when logging is not desired. During the scanning cycle, all of the equipment is operating except the final printout and data accumulation steps.

The main function of the scanning cycle is to detect variables which are outside the upper or lower limits set up for them in the programer. The alarm mechanism operates during scanning just as it does during logging.

In some units recorders are actuated when an abnormal value is detected during scanning. In others, the electric typewriter is automatically started, and the abnormal value is printed out on the log sheet in the proper place for "off-limit" recording.

Nonprocess uses . . . Loggers will undoubtedly be utilized for several nonprocess uses. The advent of automatic gaging of oil levels in tank farms means that loggers could be used to great advantage for centralized processing of gaging data.

Loggers will be especially valuable in pilot-plant operations. A great mass of detailed data must be recorded and analyzed in these operations, and logging will make this job much easier and more efficient. Loggers will also be valuable in a number of oil-industry testing operations.

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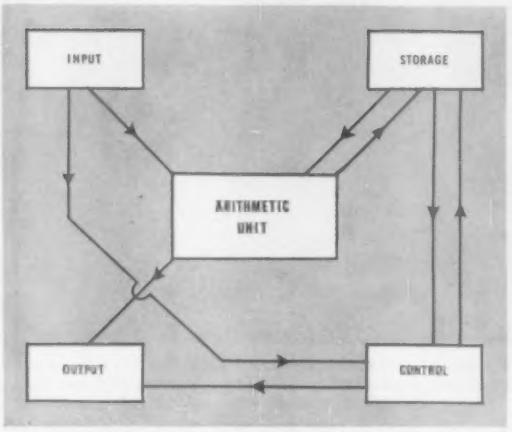
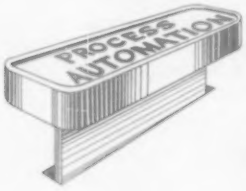


THE DIGITAL COMPUTER is made up of five component parts. Information is transferred back and forth several times during the solving of a problem. Fig. 1.

THE SMALL DIGITAL COMPUTER has many uses in business and industry. This machine, the IBM 607 electronic calculator, performs and checks 14,000 computing operations per minute.



ELECTRONIC COMPUTERS . . .

More and better information, quicker

MANY applications of electronic computers are now being made in petroleum refineries and other oil-processing plants. These machines make long, detailed calculations very rapidly, thus enabling process engineers and members of management to get complete process information quickly and accurately.

The computer may be considered as an advanced type of calculating machine. Its advantage lies in its very high speed and accuracy. Speeds of 500 to 500,000 arithmetic operations per second are possible. The computer is in no sense a "brain," because it cannot take care of any eventuality that hasn't been foreseen and adequately provided for.

Every step involved in computer operation must be planned in advance. It is possible for the computer to take alternate routes in the solution of a problem, depending on the results of preliminary calculations. But the alternate routes must have been planned in advance, and the computer must have been given proper instruction as to which route to take when a certain preliminary answer is obtained.

The decision to use electronic computing techniques cannot be taken lightly. The computers are complicated, and outside help of some sort is needed. Either independent consultants or personnel at computer service centers maintained by computer manufacturers can give the initial evaluation of the need for computing services. Ultimately, if the decision is made to install a computer, a whole new staff must be hired to operate and maintain it.

However, in spite of these required outlays of equipment and personnel, the advantages which accrue to the operator of an integrated refinery are many. Much more information can be obtained about any given process. This results in better operation because of better understanding of the process. Engineers and other technical personnel can be used to better advantage when they can divest themselves of the tedium of making routine calculations. Calculations which were literally impossible because of time requirements become feasible.

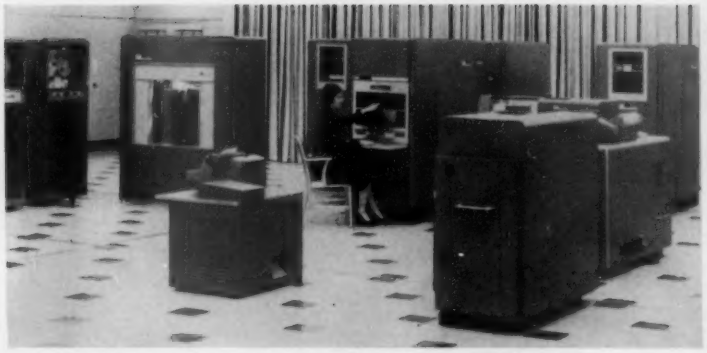
Reliability . . . Electronic computers are currently more reliable than any other computational facility, including the human operator. While some of the components in older machines showed some weaknesses, the new components are being made more stable and less subject to wear.

Methods of detecting faulty components, or even those which may become faulty, are improving. Several components are being placed on one removable, replaceable tray. Trays are replaced routinely, and the components on the removed tray are then checked without disturbing the operation of the machine. Improvements are being made in the methods of checking computer circuits, and the circuits themselves are being made more durable and foolproof.

All in all, electronic computers currently provide accurate calculations at the lowest cost per arithmetic operation, and the outlook is for decreased costs, greater accuracy, and more reliable equipment.

Types of computers . . . Electronic computers may be divided into two classes, analog and digital. In the analog computer, natural processes are combined to form an analogy to the problem under study. For example, a process flow system may be studied by constructing an analogous electric network. Electric current simulates the flow; electric potential simulates the voltage; and voltage loss simulates flow pressure drop. Electrical resistances are used to simulate valves and fittings in the flow system.

Mathematical operations, such as multiplication, differentiation, and integration, may be performed by the analog computer. Ability to carry out more complicated mathematical functions makes the analog instrument especially valuable in automatic control.



THE MEDIUM-SIZE DIGITAL COMPUTER now finds comparatively wide application in industry. This machine, the I.B.M. 650 RAMAC is a basic magnetic-drum data-processing machine with a random-access memory unit.

SHELL USES THIS ELECTRODATA computer to solve many problems. Machine shortens time lag between research and commercial production.

"Electronic computers have a bright future . . . with

The analog computer usually delivers its results in the form of a continuous curve, analogous to the behavior of the system under study. Since the solution is continuous, such concepts as distance, velocity, and acceleration may be included. It is easy to visualize the system under study from the graphical representation of results.

The graphical solution is, in many cases, the most convenient for engineering interpretation. Studies of the effects of various process variables may be made quite easily. Current through the analog circuit can be varied 10 per cent, to determine the effect of changing process flow rate by 10 per cent. Voltage can be changed to simulate the effect of a pressure change. There are many possibilities for such study, depending on the process.

The solution of an analog computer cannot be made exact, and it is not possible to determine exactly how accurate the solution is. The more complicated systems can be made to give accuracies of more than 99 per cent, but most analog units do not. Fortunately, there are many applications where this is not limitation, and where a picture is expected system action is more important than absolute numerical magnitude.

A common form of analog computer, the electronic differential analyzer, contains several types of electronic devices. Very high gain d.c. amplifiers (operational amplifiers) are employed to modify input voltages by appropriate mathematical functions. These elements make possible differentiation, integration, and algebraic. Precision potentiometers and electronic multipliers or electromechanical multipliers make possible the multiplication and division functions. Nonlinear effects are simulated by relays and diodes.

The digital computer . . . The digital computer gives a solution to a problem in the form of numbers, and results may be made accurate to any desired degree. A digital computer is actually a desk calculator with a built-in operator, either electronic or electromechanical. As shown in Fig. 1 there are five sections in a digital computer: the arithmetic unit, automatic control, storage or memory, input and output.

The arithmetic unit is an electronic desk calculator. All operations are fundamentally forms of addition. Subtraction is carried out by adding complemented numbers; multiplication is successive addition; and division is carried out by making successive negative additions.

The control unit of the computer causes the computer to perform the desired operations on selected data in a predetermined sequence. This sequence is determined by the instructions which are stored in the memory unit as numbers. The control unit selects the next instruction, based on the result of the previous computation by the machine itself. This selection ability is perhaps the most important single characteristic of the digital computer.

The storage unit incorporates such devices as magnetic drums, electrical relays, electrostatic tubes, wire or tape, and similar devices to record instructions, input data, intermediate results, and final results.

The input unit feeds instructions to the computer. These instructions are put on punched cards, magnetic tape, punched paper tape, or magnetic wire. Manually operated keyboards may also be used.

The output from the computer may take almost any desired form. Typewritten pages, plotted curves, photographed characters, and control pulses are some of the more common ways to show the results.

Operating the computer . . . Most computer installations are operated by specialists. The process and research technical personnel hand a statement of a problem to the computing staff. A member of this staff will then prepare the problem for machine solution. He will then check with the people who originated the problem to see if his interpretation is correct.

The corrected problem is then prepared for the machine input unit. Once all data and instructions are in the storage unit, machine calculation starts. There may be several types of calculations, each calling for a new machine program. After all these results are available, the originator of the problem and computer specialist again confer to see if the answers were "reasonable."

Another procedure now being used at some computer installations calls for the originator to actually operate the machine himself. The computer staff acts as a technical service group, advising and helping with the mechanics of machine operation. This procedure seems to be very satisfactory in some instances.

Computer Application

Perhaps the greatest value of the electronic digital computer in processing is process planning. This holds true particularly for a refinery. Amounts and kinds of crudes change. And, after the crude distillation, the processing variations in the modern refinery are almost endless.

Refinery operation . . . The large

THIS LARGE-SCALE DIGITAL COMPUTER is used for solving complex scientific, engineering, and business problems. The machine executes most instructions at a rate of 40,000 per second. Magnetic cores and magnetic tapes store information accessible in fractions of a second. This is the I.B.M. 704 unit.

greater application to problems of a batch nature."

digital computer can be programed to simulate the operation of a particular refinery, and results can be obtained which will outline the processing program to attain a given desired end. The plant can be operated to give a maximum amount of high-octane gasoline. Or it can be operated to yield a given amount of gasoline of given specification at the most economic level.

The particular results desired depend on market conditions, stocks in storage, and many other related factors.

Data needed for the study include crude slate, cracking conditions, principles of feed selection, specialty requirements, product specifications, reforming conditions, and economic data.

The crude slate consists of names, types, and amounts of each crude that is being processed. Preliminary crude-distillation cut points are needed. These are revised later in the study, depending on some of the preliminary results.

Cracking conditions, such as conversions as functions of the principal operating variables, must also be made available to the unit. **For each processing step,** the feed stocks must be selected, and in the order of their preference. It is also required to select the units which should be operated to capacity, when alternate processing arrangements are possible.

Product specifications for each finished stream must be given to the computer. In addition, amounts of **specialty products** are designated.

Required **economic data** include costs of crude, prices of finished products, processing-cost equations, and similar.

Results . . . Results from the computer analysis will show yields and qualities for all products, yields and qualities from each process, levels for all operating variables, and a cost-profit analysis.

In one refinery this analysis is carried out in this order:

1. The computer splits each of the crudes by atmospheric and vacuum distillation into the required virgin streams. At a later point in the calculation, the cut points on these streams are adjusted.
2. The second step has to do with visbreaking of the vacuum pitch in accordance with desired severity.
3. Next, operation of the catalytic-cracking section is determined. Feed stocks are allocated between two catalytic-cracking units, in accordance with the stipulated preference order.
4. The fourth step involves the thermal cracking of cat-cracker cycle stock.
5. The processing sequence for light ends is next determined.
6. After determining light-ends operation, heating oil is balanced out to three separate specifications. This section involves feedback to the crude-distillation step, as mentioned.
7. Finally, the gasoline operations are determined. This involves catalytic-reforming operations and gasoline blending. Feedback from blending is to catalytic reforming, and perhaps to distillation and heating-oil operations.

Other uses . . . Many of the other uses for the electronic computer in processing are either outlined or implied in the simulated refinery operation. However, there are a number of others.

The computer is particularly suited to **absorber design.** These units have such complications as intercoolers, widely varying vapor rates, and the absorbing effect of heavy components in the feed. The machine solution is simply a series of trial-and-error passes down the column for different overhead compositions until the calculated vapor to the feed step equals the actual absorber feed.

Hydrocarbon fractionation where sharp separations are required is handled easily by the computer. Empirical equations of state and thermodynamic equations may be used without undue difficulty.

In **thermal or cat-cracker design,** the computer can handle kinetics, catalysis, heat transfer, and pressure-drop correlations. **Condensers** for fractionators, in which two-phase heat transfer is involved, may be handled. **Control instruments** may be located properly on a unit. This problem deals with unsteady-state and transient effects, and is very difficult and time consuming by manual methods.

Heat and material balances around units and entire plants are determined swiftly by the computer. **Molar analyses** are obtained from the peak readings of a mass spectrometer by the solution of a set of linear simultaneous equations. **Infrared analyses** require the repetitive solution of a similar set of equations. **Correlations of data** in both pilot and commercial plants may be made by the computer. Such correlations require exhaustive treatment of many, many possibilities when done manually.

The computer may also be used in the solution of multicomponent distillation, extraction, fluid flow, heat transfer, chemical-reaction equilibrium, chemical-reaction kinetics and catalysis, cooling-tower, and vapor-liquid equilibrium problems.

The uses of the computer discussed thus far are not connected directly

with automatic control. They do lead to better process understanding, and to better process operation **through** automatic control.

Thus far, no digital computer has been incorporated into an automatic-control setup, and it appears that it will be several years before there is such application. The problems of automatic feeding of data to the computer in proper form, and of proper feedback to the other parts of the control system are quite complicated. They are not insurmountable, and the step will come in time.

Analog Computers in Control

Meanwhile, however, the story of analog computer application in the control system is somewhat different. In a manner of speaking, even the simplest controller is an analog computer. The controller operates on a pneumatic or electrical analog of the process variable. The simpler controllers use analogs that are quite crude. And even the proportional-reset-rate controllers are not greatly refined, in that only one variable is measured.

The analog computer as usually defined is much more complicated than the usual controller, and its analog is much more like the complete process it is simulating. Rather than considering just one variable, the analog computer in control determines the effects of several of the most important variables.

Analog computers for control application have been available for the past 2 or 3 years, but no installations have been made in the petroleum-processing field until recently.

Cuban installation . . . A programed general-purpose analog computer will become an integral part of oil-refinery process control at the Belot refinery of Esso Standard S.A. near Havana, Cuba. (See last figure, page 131.) Eleven basic operating guides will be calculated by the computer, along with 101 critical process variables, and recorded hourly by an automatic data logger. The operating guides may be determined at other times as necessary.

There is no feedback from the computer to the controllers in the fluid cat-cracking plant where the unit is to be installed. The major contribution of this data-handling and computing system will be up-to-the-minute operating information. This will permit closer process control.

The computer will process pressure, temperature, flow, and other readings from the catalytic-cracking unit, and feed values of these variables into the computer program of predetermined equations. Results will be in the form of 11 key sets of data known as operating guides. In general, operating guides refer to computable data which are useful in guiding the operation of the process unit.

Typical operating guides which will be determined are carbon-burning rate in the catalyst regenerator, catalyst circulation rate, and heat duty of pumparound circuits.

The two heat-duty guides involve straightforward multiplication of several factors. They measure amount of heat removed from a bypass stream withdrawn from the primary tower, passed through heat exchangers, and then returned to the tower. The logged solution is expressed in millions of B.t.u.'s per hour.

Catalyst flow . . . The computation of catalyst flow rate is more complicated. It depends on flow rate of carbon dioxide leaving the regenerator, flow rate of carbon monoxide leaving the regenerator, flow of air entering the regenerator, total flue-gas flow rate, regenerator temperature, and temperature of incoming air. The flow rates are separately calculated and held in storage for use in computing other operating guides.

This combination logger-computer was designed as a general-purpose analog device with automatically programed solution of process relationships, in order to achieve the lower cost, reduced maintenance, and smaller physical space characteristic of modular computer construction.

The available operating time of the summation modules, coefficient modules, and multiplication or division modules is programed and shared to solve for the operating guides with minimum duplication of equipment. All analogs will be represented as a.c. voltages, thus eliminating the need for precisely regulated and standardized d.c. supplies.

A.c. coupling will be used throughout to avoid random d.c. drift in any of the operational modules. Continuous-duty cycling, with no down time for balancing adjustment, is then expected.

Components of analog computers are like those of loggers, and it may therefore be assumed that they will prove practical under refinery operating conditions. It is not known whether the Belot computer will be of sufficient value to justify its installation economically; this is an experimental installation, and the possibilities are sufficiently large to justify it on a development basis.

Indications are that the computer will more than pay for itself in a short period of time.

Other analog needs . . . There are a number of immediate needs for small-to-medium analog computers in petroleum processing. One is for calculating analyses from peaks on the monitoring mass spectrometer. It is possible to specify a small computer which will do nothing by compute percentage composition from mass spectra.

Other applications will be immediately apparent to the process man.

The Future of Computing

Electronic computers have a bright future in the petroleum-processing and associated fields. There will be much greater application of the digital computer to problems of a batch nature. Many computers are on order; smaller companies are turning to specialized computing firms; and more and more problems are being adapted for computer calculation.

The batch calculations now being done on specific phases of refinery operation are providing information which is leading to more basic and fuller understanding of larger segments of the processing scheme. This will lead to larger computing programs and still further increase in the knowledge of interactions of variables in refining processes.

Ultimately, large digital computers should be able to provide feedback to the process controllers, and at that time, their integration into the process control scheme will be complete. It is expected that the analog computer will be utilized much sooner than the digital machine.

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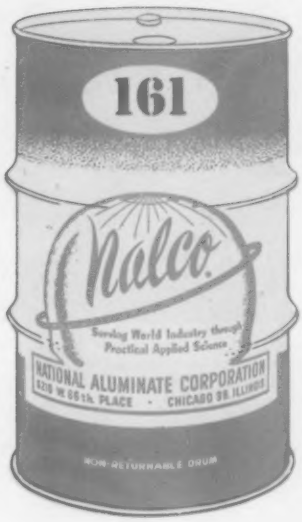
CORROSION CONTROL SERVICES



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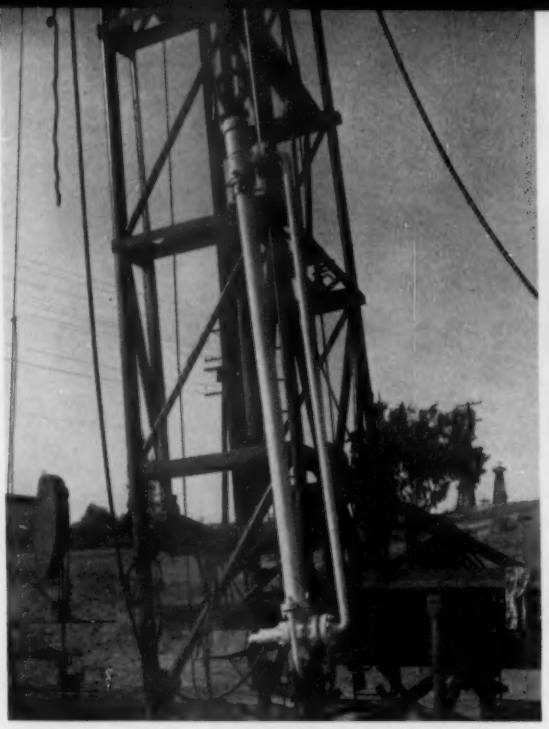
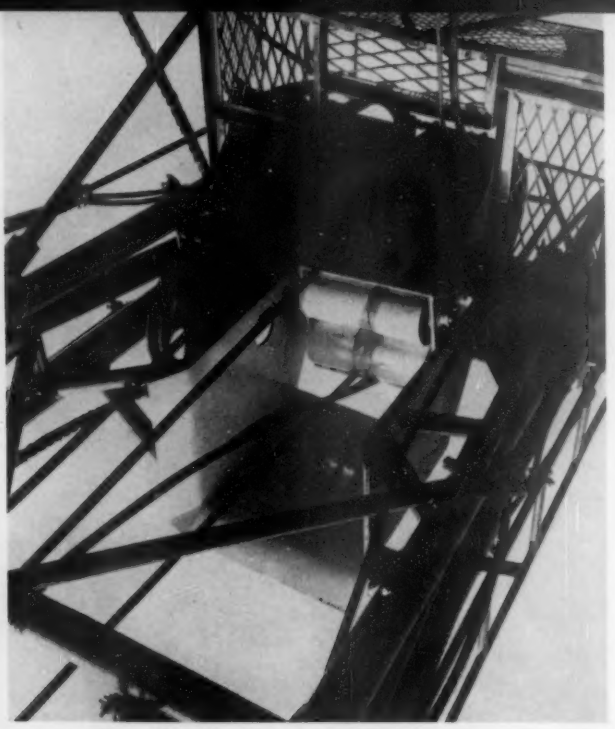


SHOCK ABSORBER consists of a main cylinder with a plunger and a fluid bypass. The deadline attaches to the plunger and the cylinder case is tied to the rig structure. (See Fig. 3 for detail.) Fig. 1.



RUBBER BUMPERS prevent the traveling block from hitting the crown. When the block hits the bumpers, the tension in the wire line increases and pulls shock absorber plunger free. Fig. 2.

Hydraulic shock absorber cushions bump . . .

New Safety Devices Reduce Rig Accidents

by D. H. Stormont
District Editor

SHELL OIL CO. as part of its safety program has installed devices on several of its California workover rigs and pulling units to minimize crown accident hazards. Two different methods have been used to solve the problem of preventing an accident when the traveling block runs into the crown block. Each has proved successful.

A serious hazard is present when the crown block on a mast or derrick is accidentally hit by the traveling block. The hoisting line may be cut or pulled apart, allowing the block to fall and endanger the lives of workmen.

Although such accidents are rare, due to the training and alertness of the hoist operator, they can happen. To prevent such an occurrence, Shell engineers devised two types of crown accident preventers. Most well-servicing and workover rigs for the company's California operations are now equipped with these safety measures.

The hydraulic shock absorber, one type of crown accident preventer, is designed to dissipate the energy in the hoisting system when the traveling and crown blocks collide. It works something like a hydraulic door closer.

The other consists of electrical circuits which control air-operated devices designed to disengage the clutch, apply the brake on the hoist, and sound a horn.

Hydraulic shock absorber . . . Fig. 1 shows the hydraulic shock absorber installed on one well-pulling unit, with the deadline attached at the top of the absorber. Fig. 2 is a photograph taken looking up at the crown and shows a welded steel cage and two rubber bumpers.

When the traveling block is near the crown, the cage guides the block to prevent it from twisting and fouling the lines. On striking the rubber bumpers, the top of the block compresses them against a steel plate and distributes the force over it. The forces in the wire line then build up rapidly and are transmitted to the deadline.

Shear pins in the top of the shock absorber (see Fig. 3) fail when the line pull exceeds 35,000 lb., about half the ultimate strength of a 1-in. line. When this occurs, the piston is free to move up in the cylinder.

A small amount of air in the top of the cylinder is first compressed. This air is necessary to allow acceleration of the plunger, rod, fluid, and other moving parts before the hydraulic pressure increases materially.

When the hydraulic pressure builds up to preset value of 3,000 psi., the spring-loaded relief valve opens. This valve is flanged to the bottom of the absorber cylinder as shown in Fig. 3. Energy in the hoisting system, chiefly in the rotating hoist drum, is then absorbed by the hydraulic fluid flowing through the variable orifice of the relief valve. During the 10-ft. piston stroke the line slows down and stops, thereby killing the engine.

The design of the hydraulic shock

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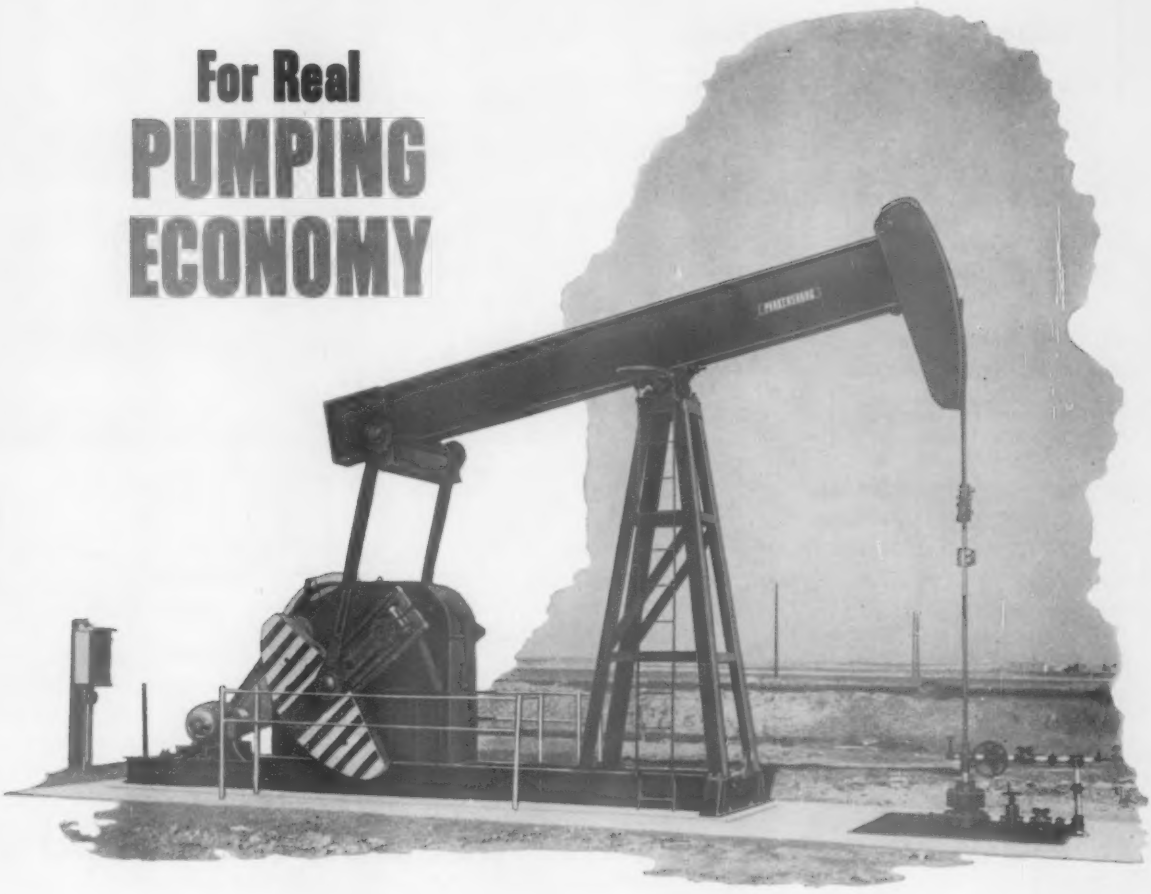

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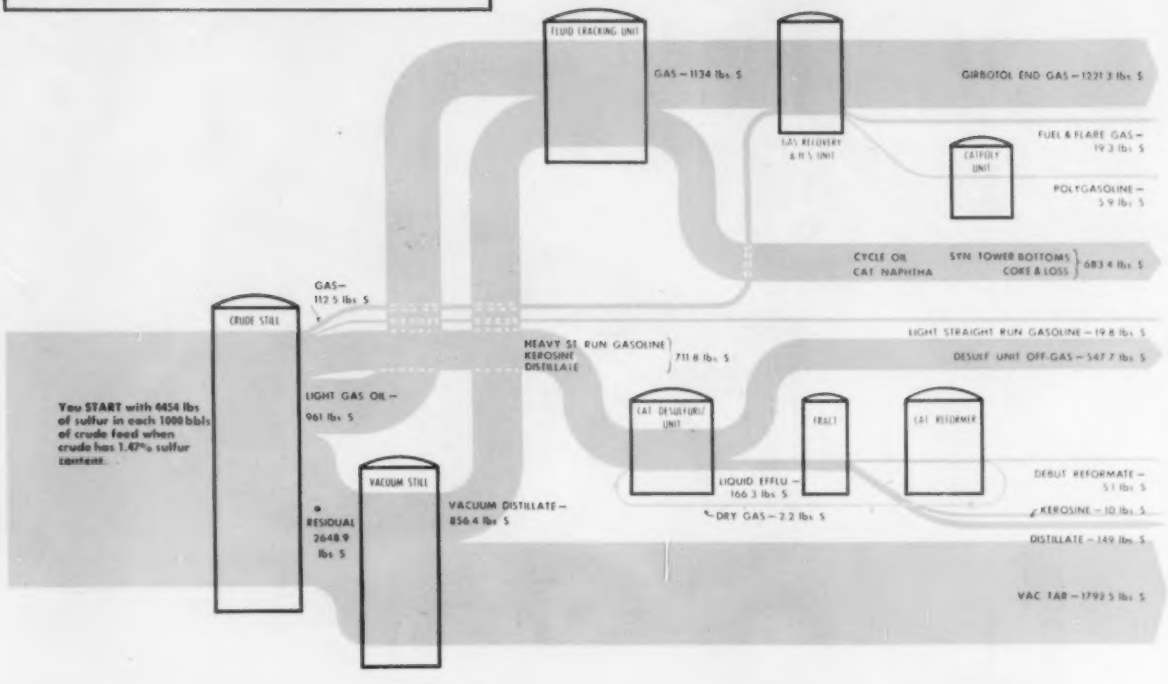
FLUID CRACKING UNIT
GAS – 1134 lbs S
GAS RECOVERY & H2S UNIT
GIRBOTOL END GAS – 1221.3 lbs S
FUEL & FLARE GAS – 19.3 lbs S
CATFOLY UNIT
POLYGASOLINE – 5.9 lbs S
CYCLE OIL CAT NAPHTHA
SYN TOWER BOTTOMS COKE & LOSS
683.4 lbs S
GAS – 112.5 lbs S
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You START with 6454 lbs of sulfur in each 1000 bbls of crude feed when crude has 1.47% sulfur content.
LIGHT GAS OIL – 961 lbs S
HEAVY ST. RUN GASOLINE KEROSINE DISTILLATE
711.8 lbs S
LIGHT STRAIGHT RUN GASOLINE – 19.8 lbs S
DESULF. UNIT OFF-GAS – 547.7 lbs S
CAT. DESULFURIZ. UNIT
FRACT.
CAT. REFORMER
VACUUM STILL
RESIDUAL 2648.9 lbs S
VACUUM DISTILLATE – 856.4 lbs S
LIQUID EFFLU – 166.3 lbs S
DRY GAS – 2.2 lbs S
DEBUT REFORMATE – 5.1 lbs S
KEROSINE – 10 lbs S
DISTILLATE – 149 lbs S
VAC TAR – 1792.5 lbs S

How to save up to 7¢ per barrel on lead

Ethyl Research studies show you can increase the octane number by decreasing the sulfur . . . and use less lead!

Getting the most from your lead is a complex business involving among other things, hydrocarbon blending and control of sulfur concentration in the fuel to be leaded. The Ethyl Corporation is constantly studying the interrelation of all the variables which affect lead utilization.

The antagonism of sulfur and tetraethyllead has long been known, but the refiner's problems today are 1) how much sulfur can justifiably be removed on the basis of savings in tetraethyllead and 2) what process can best be used to remove this sulfur. The advent of large volumes of high-pressure hydrogen at relatively low cost as a by-product of catalytic reforming processes has altered the entire economic picture of sulfur removal.

Actually the over-all justification of sulfur removal at one point or another in the refinery is composed of a number of complex factors including:

1. **Decreased product odor**
2. **Decreased refinery corrosion**
3. **Lessened refinery operating problems**
4. **Improved color and lessened gum formation**
5. **Improved tetraethyllead response**
6. **Sale of recovered sulfur**
7. **Avoidance of catalyst poisoning**
8. **Improvement in lube-oil life in the engine**

Of these various factors, perhaps the easiest to assign dollars-and-cents justification to (and certainly the one with most widespread application) is a saving in tetraethyllead.

Figure 1 shows the effect of the type of sulfur compound on Research octane number loss. This plot is based on U.S. pool gasoline which has a 79.2 Research octane number clear and a 92.0 Research octane number with 3 cc. of lead, and which contains 0.075 per cent total sulfur which may take the

form of the various compounds shown below.

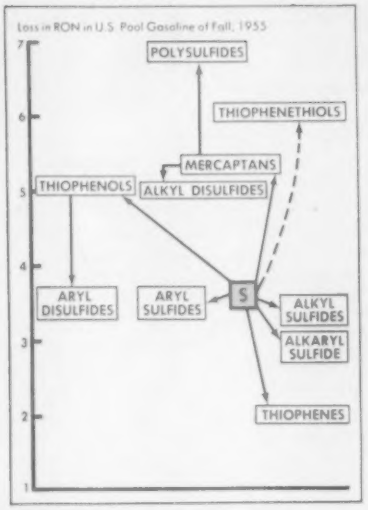

Fig. 1. *Effect of type of sulfur compound on RON loss*

Actually, a reasonable assumption would be that gasoline contains half monosulfide sulfur and half thiophenic sulfur. Complete removal of this sulfur, although economically attractive, is a practical impossibility. With the advent of hydrogen treating, however, there is no reason why 50% sulfur removal cannot become a reality. Figure 2 illustrates the TEL savings which are possible with 100%, 75% and 50% sulfur removal from U.S. pool gasoline of 91 RON with 2.38 ml. of TEL.

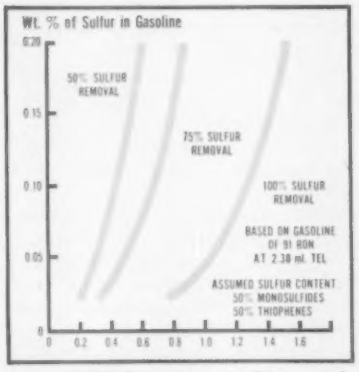
Wt. % of Sulfur in Gasoline
50% SULFUR REMOVAL
75% SULFUR REMOVAL
100% SULFUR REMOVAL
BASED ON GASOLINE OF 91 RON AT 2.38 ml. TEL
ASSUMED SULFUR CONTENT 50% MONOSULFIDES 50% THIOPHENES

Fig. 2. *TEL savings (ml. per gal.) with sulfur removal*

The average refiner, while he may be interested in the above data, still wants to know, "What's in it for me?" and Figure 3 answers this question. Here the possible savings in cents per barrel of gasoline are shown as a function of the weight per cent sulfur in the gasoline pool. This relationship is independent of the lead susceptibility of the particular stock and of the Research octane number level. Here, again, we are assuming half monosulfide sulfur and half thiophenic sulfur, and the economics of 50 and 75 per cent sulfur removal are shown for TEL levels of 1.5 and 3.0 ml/gallon.

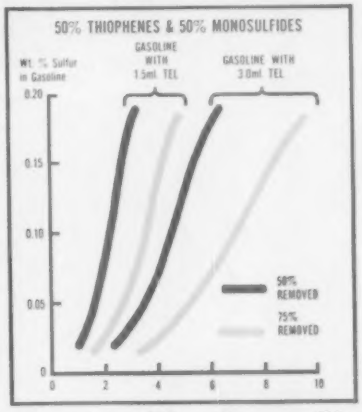

Fig. 3. *¢ per bbl. savings possible*

For example, it can readily be seen that a pool gasoline requiring 3 ml/gal of TEL and containing 0.10% sulfur could meet the same octane specifications with a saving in TEL cost of 7 cents per barrel if 75% of the sulfur were removed.

It is not unreasonable to assume that pool octane number could be raised one unit by desulfurization. Current octane-improvement costs, as shown by recent Ethyl studies, range as high as 16 cents per Research octane number per barrel. Therefore, 16 cents per barrel could be considered a justifiable expenditure for desulfurization on the basis of Research octane quality alone. Your justification will depend on the conditions specific to your refinery.

The optimum operation of your refinery to permit you to make the most of your lead could be the subject of a profitable discussion with your Ethyl refinery technologist. Your Ethyl Representative will be glad to arrange an appointment for you.

What Ethyl Research offers you

At today's high octane level, the advantages of getting more efficiency from your lead have taken on more and more importance. To complement the intensive effort which the industry is devoting to this problem, Ethyl Research is continuously studying how the hydrocarbon blending and sulfur removal factors can lower lead requirements.

We are constantly testing and probing all the variables which affect lead utilization in today's high-compression engines. The problem of sulfur removal and the sudden entrance of high-pressure hydrogen, as a by-product of catalytic reforming, into the economic picture is being watched very carefully at Ethyl Research. Write to Ethyl Corporation, Box 11, for a copy of "Sulfur in Gasoline—an Economic Appraisal"—another in the continuing series of reports from the Ethyl Corporation on fuel blending and other studies of vital interest to refiners today.

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absorber was worked out after calculating all of the forces involved in the hoisting system. There is obviously no problem when the line speeds are low because the engine will stall when the rubber bumpers are hit. The problem is to absorb all the energy in the system when operating at the highest line speed.

Calculations showed that the energy to be absorbed with this particular unit when operating in high gear at a fast line speed of 1,700 ft. per minute was 240,000 ft.-lb.

Field tests . . . After the hydraulic shock absorber was built, a field test was made, with the controls removed a safe distance from the rig. Oscillograph recording instruments provided records of the various speeds, pressures, and forces involved. The blocks were run into the crown with the pulling unit in high gear and the engine at full speed, which is the severest condition. The engine stopped before the piston in the shock absorber reached the end of the stroke.

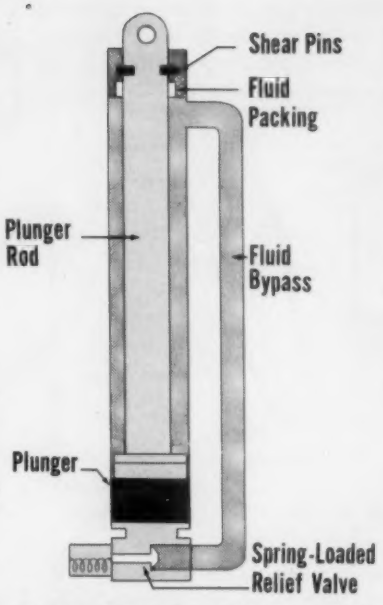
Calculations from the recorded data showed that the energy absorbed by the hydraulic cylinder was 204,000 ft.-lb. This was somewhat less than the calculated energy in the system, which was derived by neglecting friction and clutch slippage.

. . . Advantages of the hydraulic shock absorber are:

1. It needs no maintenance.
2. It can be used on masts with minimum head room.

. . . A disadvantage is that it adds about 1,200 lb. to the weight of the pulling unit.

At least one accident has been prevented during a pulling job by the shock absorber when the block was inadvertently run into the crown. The pins sheared and the plunger pulled out a few feet. No damage was caused.



ACTION of the shock absorber starts when deadline load becomes high enough to shear pins. The plunger moves upward displacing fluid and building up pressure. At 3,000 psi. the relief valve opens. Fluid flowing absorbs hoisting energy. Fig. 3.

Electropneumatic device . . . Fig. 4 diagrams the operation of the crown accident preventer which uses an electropneumatic system. Shell engineers started with the Baash-Ross traveling-block signal-warning control. This consists of a weight-loaded electrical switch on the crown platform and the solenoid valve on an air line. The valve opens and blows an air horn when the traveling block hits the sliding weight assembly on the deadline and opens the switch, normally held closed by the weight.

Electropneumatic devices were added to this warning conhtrol to (1) release air from the air supply line to the clutch, thereby throwing out the clutch; and (2) apply air to a cylinder that sets the hoist brake. Referring to Fig. 4, these devices operate as follows:

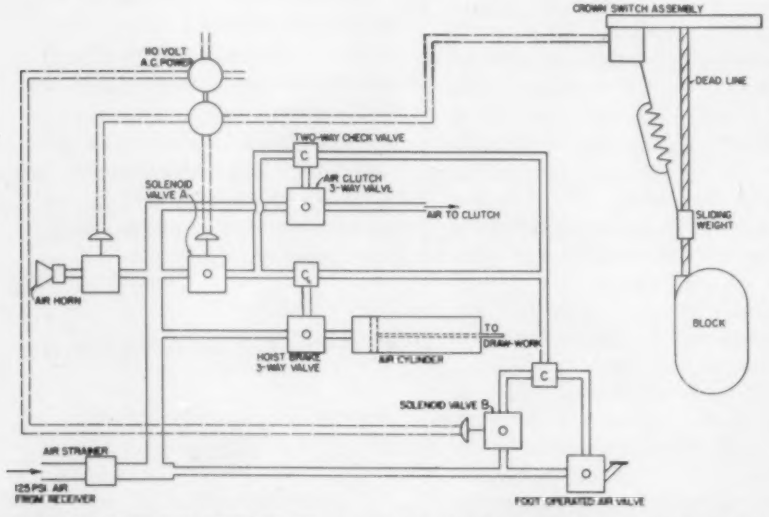
When the traveling block is raised high enough in the mast to open the crown switch, deenergizing the electrical circuit, three-way solenoid valve A not only shuts off the air-pressure supply to the control piping but also bleeds the air pressure from it. This release of air pressure actuates both the air clutch and hoist brake-control valves, throwing out the clutch, applying the brake, and preventing the traveling block from running into the crown.

Two other control devices are necessary for safe operation of the hoist: (1) the foot-operated air valve that bypasses the safety controls, and (2) the solenoid-operated air valve B that opens when there is a power failure.

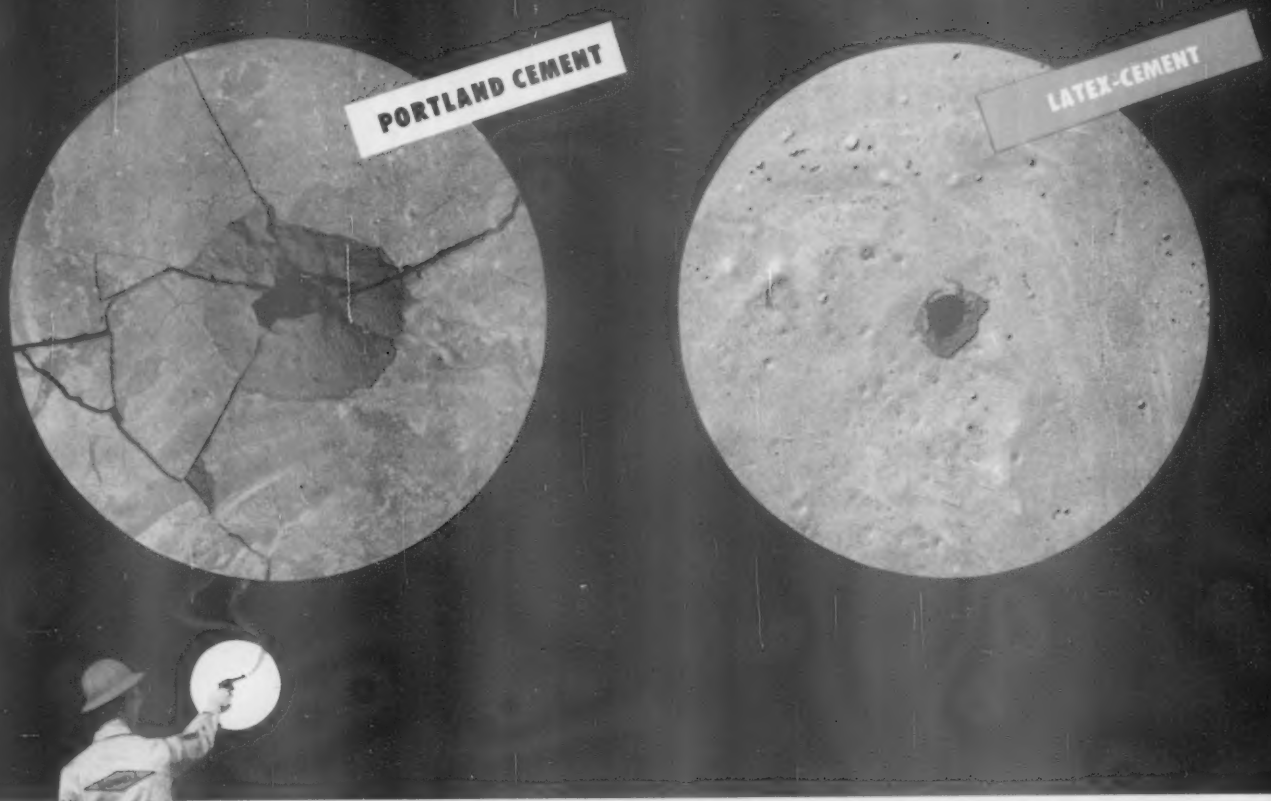
Releasing control . . . The foot-operated three-way air valve is provided to release the brake and engage the clutch when the traveling block has been automatically stopped in the danger zone, thereby allowing the block to be lowered. Stepping on this spring-loaded valve pressures the control piping and returns the air-operated control valves to their normal position. This is possible even though solenoid valve A is venting the control piping because two-way check valves are installed directly above the two air-operated control valves. The spring-loaded valve assures that the bypass cannot be left open.

For fail-safe operation, if the power is interrupted, three-way solenoid valve B is provided. This valve opens whenever a power failure occurs and pressures the control piping. It performs the same functions as the foot-operated valve. The two-way check valve above valve B prevents air from venting through the foot-operated valve. Power failure, therefore, does not operate the clutch or brake, but the warning horn blows. The problem of having the brake set and the clutch thrown out while running or pulling a heavy load is thereby avoided.

Acknowledgment. — Appreciation is expressed to Shell Engineers R. C. McNeill and F. E. Davis, Los Angeles, and Alex Kerr, Ventura, for supplying the material for this article.



CROWN ACCIDENT PREVENTER uses electric signal and pneumatic controls to stop hoisting if traveling block rises too high. When block hits sliding weight, solenoid valve A operates to cause a release of air to clutch and brake The clutch is thrown out and the brake applied. Fig. 4.



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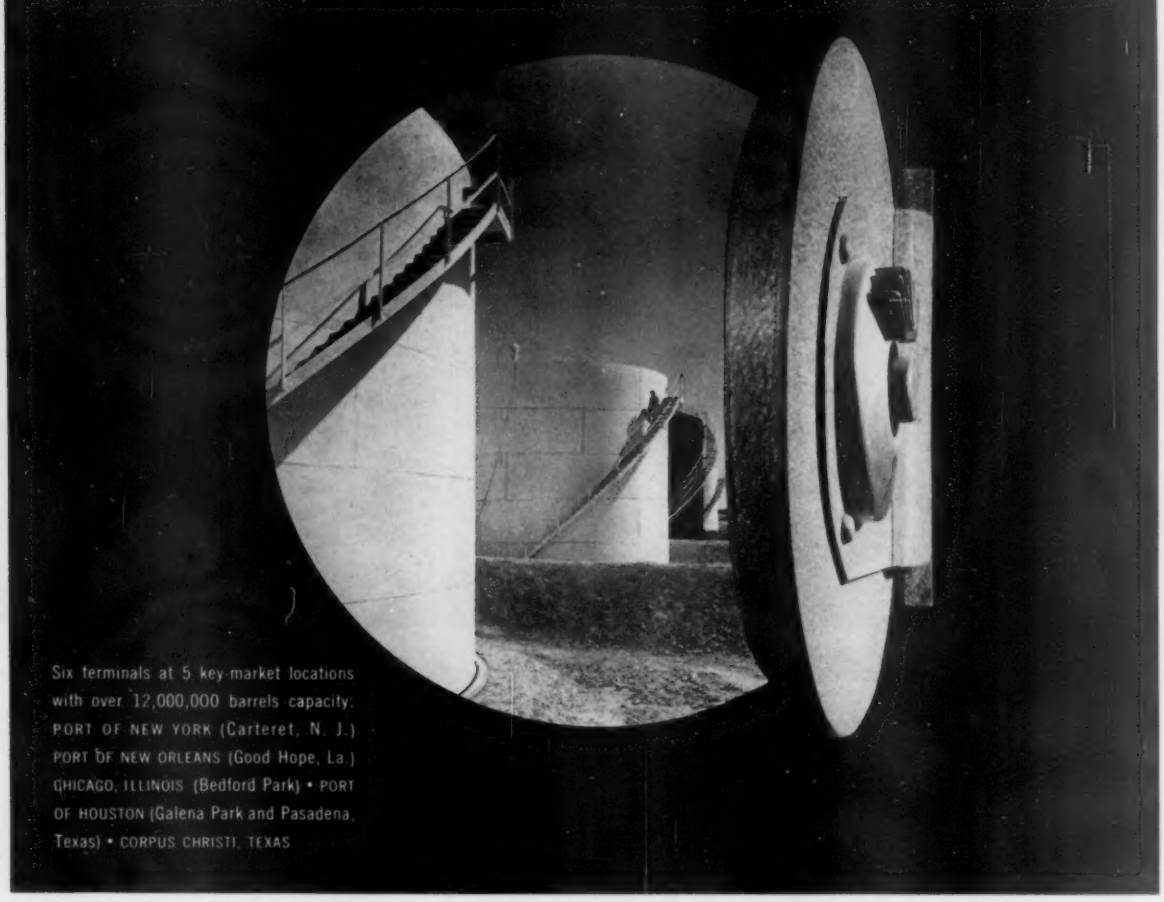

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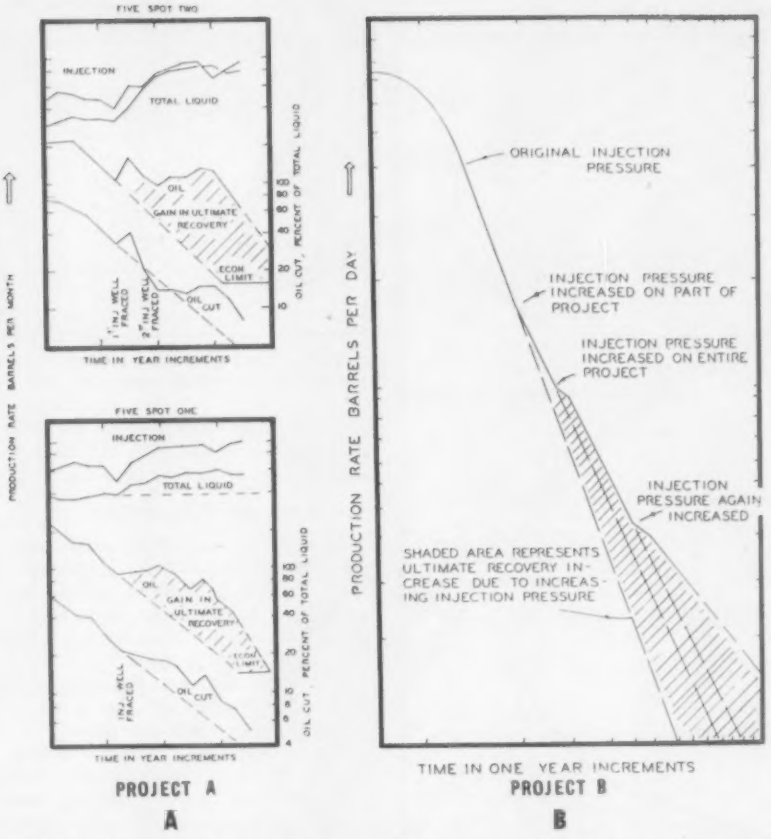


EFFECT of increasing rate of injection on ultimate recovery: Project A rate increased by fracturing injection wells. Project B rate increased by increasing pressure but still staying below formation breakdown. Fig. 1.

Author urges . . .

Don't Prorate Water Floods

"Preponderance of literature definitely supports high rates and nonshutdown of water floods . . ."

by Bert Murphy

SINCE the middle twenties when it was first realized that the pressure head of water upon the producing sand determined the rate at which the water would enter the formation, the industry has been concerned with the effects of injection and production practices on flood performance, particularly ultimate recovery. Evidence indicates that:

1. The higher the rate of injection up to formation breakdown pressure, the greater the ultimate recovery.

2. If injection rates are reduced or if injection is stopped, oil will be lost and will not be regained even by again increasing rate of injection.

3. Greater ultimate recovery will result from capacity pumping of producing wells where economics do not become an important factor.

There are only three controls on injection and production practices in water-flood operations concerned with primary - depleted granular reservoirs. The first of these is the project characteristics. The second is the operator and the third the various state and federal regulatory bodies.

The project characteristics have set the stage and the operator tries to give his best performance. Regulatory bodies have been a highly interested and approving audience.

When the operator begins his flood, he has these controls imposed on him by nature: One or more sources of water, a formation to flood at a given depth, and with a given capacity to transmit fluid. The prudent operator attempts to secure an adequate supply of water that will not plug his formation or destroy his equipment. He will complete his wells in such a way they will transmit a maximum amount of fluid in the productive zone only without bypassing. He is then faced with the problem of how he will operate his project with regard to manner and amount of injection and production.

Reviewing Literature and Testimony

A statement was made before a state regulatory body that most technical literature agrees that no increase in recovery will result from flooding at high rate. Investigation of the literature on this subject shows this statement to be false.

What literature shows . . . A review of all available literature concerned with the way in which injection and production practices affect water-flood performance reveals 46 pertinent works presented from 1925 to September 1956. Thirty-nine of these works support one or more of the three conclusions given above.

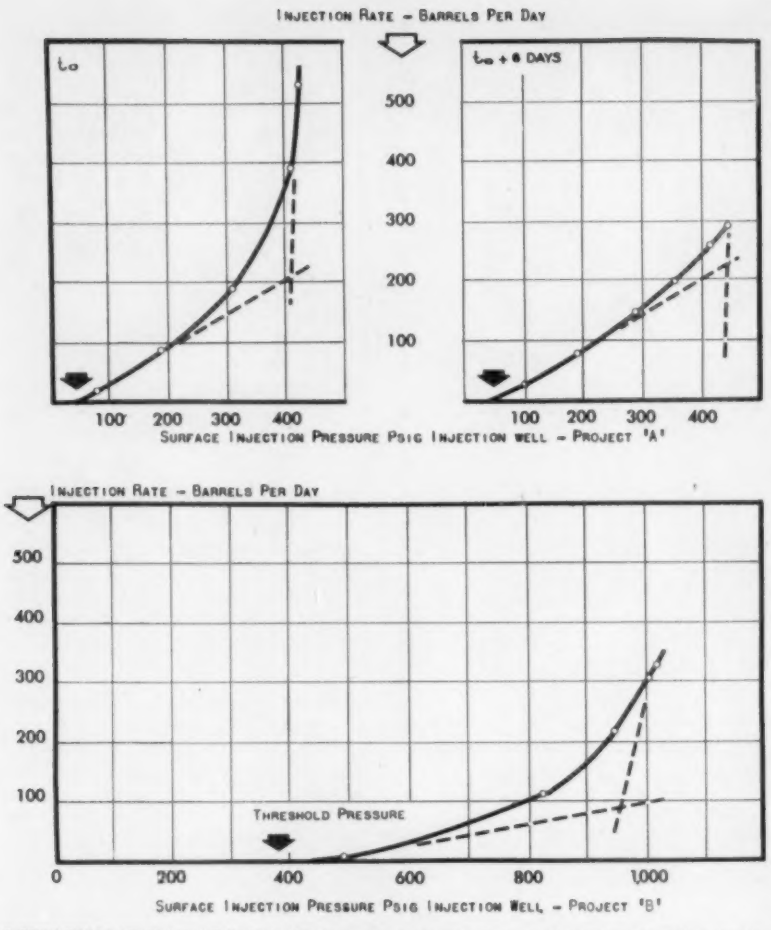
Only two of the articles indicate that high injection rates would result in lower recovery. One of these was for natural water-drive fields in which gravity played an important part and therefore was not directly applicable to pattern water flooding. Both articles were published prior to 1943. None were found since that indicated lower recovery would result from high injection rates.

Three of the articles conclude that rates were independent of ultimate recovery. The latest of these was published in April 1951. One study published in 1942 indicates there was an optimum rate of injection and one questions the effect of rate on ultimate recovery without giving an opinion.

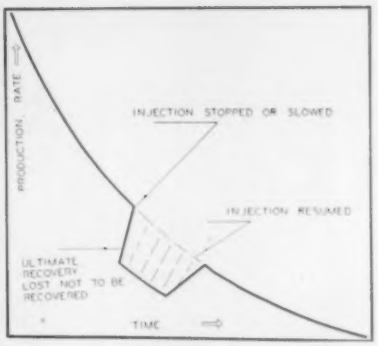
Therefore 85 per cent of the pertinent literature supports one or more of the three conclusions. Only 4+ per cent (published 12 or more years ago) indicate lower recovery by higher rates, 6.5 per cent conclude that rates and recovery were independent, and 2+ per cent that an optimum rate exists (published in 1942).

The preponderance of literature definitely supports high rates and nonshutdown of water floods.

Testimony . . . With regard to testi-



DEVIATION FROM DARCY'S LAW in pressure vs. rate tests to determine formation breakdown pressure. Threshold pressure where well begins to take water is shown. Fig. 2.



TYPICAL LOSS in ultimate recovery due to stopping or slowing injection rate. Fig. 3.

mony concerned with the effect of rate on water-flood performances two major sources of data are available. The first of these is transcribed hearings before state regulatory bodies in which sworn statements have been made. Two such hearings of interest were the Railroad Commission of Texas Oil and Gas Division, Oil and Gas Docket Numbers 126 No. 8-17208 and 126 No. 8-32791. In these, well-recognized, highly qualified water-flood operators and engineers gave testimony with supporting evidence substantiating one or more of the three conclusions. Nowhere in the hearings of state regulatory bodies that I have inspected was there testimony substantiated with evidence disagreeing with the three conclusions.

The second major source of testimony with regard to injection-rate practices is the answers to a questionnaire prepared and sent to several hundred water-flood operators by a water-flood committee studying this problem. Again the answers supported the conclusions with only one dissenter. This company gave no evidence supporting their statements and indicated their answers were only opinions.

The vast majority of the operators supported high rates and nonshutdown, and they also indicated that any artificial controls imposed on rate practices could result in marginal projects not being undertaken, a general lessening of secondary recovery efforts industry-wise, endangering correlative mineral rights, and practices not conducive to conservation.

I anticipate that interest in injection and producing practices will accelerate and that many studies will be made with the results published in the near future. The references at the end of this article indicate all the information I have located and evaluated to date. The most weight should be given to actual field performance and to the conclusions of "water flooders" who have been successful in their field operations.

It has been said that after the most intensive geophysical and geologic work "the bit finds the oil." Conversely it can be said that after all theoretical and laboratory work is done "the practices and performance in the field result in project success or failure."

Rates and Ultimate Recovery

Many of the published studies make no attempt to explain why greater pressure and rate resulted in greater ultimate recovery. However, those that do usually conclude that by increasing rate, water was put through and therefore flooded out less permeable portions of the sand not essentially affected at relatively lower rates.

Fig. 1 shows typical curves demonstrating the effect of increasing pressure on a project and increasing flood rates by fracturing wells as exampled by published exhibits and unpublished field data. The curve for project B indicates greater ultimate recovery will result from increased pressure. The extra oil comes from somewhere within the sand since it would never have been produced at lower pressure.

The somewhere could be:

1. Identical pores already being flooded.

2. Small pores which are not disturbed at lower pressures intermingled with the pores being affected.

3. Tight sand layers through which the flood is moving slowly and ineffectively at lower pressures which become more productive at higher pressures.

Project B, Fig. 1, shows two circumstances accompanying increasing pressure: (1) The curve is offset upward; and (2) the slope of the curve decreases.

The first of these would seem necessary since the whole tempo of the flood is increased. However, if there were no changes in the quantity of producible oil, the crude slope should increase since the life of the flood would need to be shorter to produce the same amount of oil at a higher rate. This does not occur. The slope decreases indicating more ultimate oil would be produced.

Other factors being constant the slope of the curve should vary with

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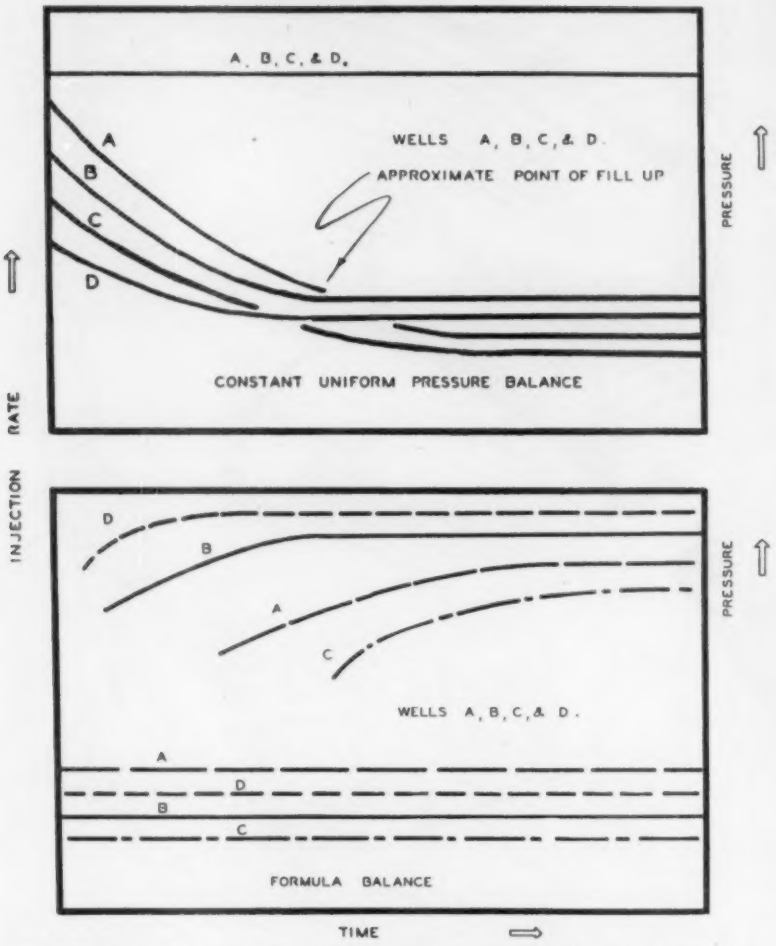

PERFORMANCE of two flood-balance methods for typical injection well. Fig. 4.

the effective permeability. The higher the permeability the steeper the slope. The fact that the slope of the curve decreases with the increased pressure suggests that the mean effective permeability becomes lower; however, the capacity becomes higher which indicates that additional tight sands become floodable with the increased rate.

More effect of pressure . . . Fig. 2 gives further evidence that additional portions of the sand are flooded at increasing pressures. This is the result of pressure vs. rate tests to determine formation breakdown in two Yates sand floods. The first test was made a few days after the well was first put on. The second, 5 days later.

The interesting point in these tests is that in the portion of the graph before breakdown is reached, the line curves upward and is not a straight line as would be expected if the sand were responding over the entire section according to Darcy's law. This may indicate that either the effective permeability of the sand being flooded is increasing, or additional portions of the sand are responding to the higher rates. The second assumption seems reasonable considering Fig. 1.

Another interesting thing about this type of curve is that for many wells several to several hundreds of pounds per square inch of pressure must be exerted at the surface, although a hydrostatic head already exists, before the wells will take water. This has been observed in many injection wells and described in the literature as threshold pressure.

Since this has been observed to be a function of permeability—that is higher and higher threshold pressures are required for tighter and tighter sands—it is reasonable to assume that as pressure is increased an increasing per cent of the lower permeability sands will be flooded. The limiting pressure is of course the point at which the formation breaks down.

Effect of Shutdown

Fig. 3 is the typical result of stopping or slowing rates. The crosshatched area represents oil lost not to be recovered, due to slowing or stopping rate of injection.

A possible explanation is that when rates are lowered or injection is shut down, the flood front reacts similarly to back-flowing an injection well for selective plugging—that is, the more permeable sands lose their pressures rapidly by allowing the water to flow forward. This allows the flood water in the tighter sand to crossflow into them and possibly creates an advanced flood front in more permeable portions of the sand. When injection is resumed a new advanced flood front is created and the pressure differential across the bypassed oil is too small to effectively move it.

Another explanation possibly coexisting with the first is gravity slumping of the front so that there is an advanced flood front formed which will bypass oil when injection is resumed. Degree of heterogeneity of the sand is an apparent factor with an increasing loss occurring with greater heterogeneity.

Flood Balance

The most controversial question on injection practices today is the method in which floods should be balanced—that is, either by a constant uniform injection pressure or by some rate formula usually involving barrels per day per foot of sand or some similar factors. The constant uniform injection pressure for most projects is preferred for several reasons.

Rule-of-thumb formulas were devised first in the early flood areas where it was found by experience that floods performed best if certain rate and pressure practices were followed. These practices were finally expressed as for-

THE AUTHOR

Bert Murphy is a Texas registered professional engineer with a B.S. degree in petroleum engineering from Stanford University and has done graduate work in reservoir engineering and evaluation at the University of Southern California. In 1948 and 1949 he worked with Continental Oil Co. and in 1950 joined Signal Oil & Gas Co. where he advanced to project engineer and supervisor of a West Texas flood project. In 1954 he was engaged as chief engineer by F. Kirk Johnson and was made assistant manager of their water-flood division just prior to the incorporation of the firm which became Ambassador Oil Corp.

Since October 1955 he has served as the chairman of a joint study committee of the Permian Basin Water Flood Association, West Central Texas Water Flood Association, and West Central Texas Oil and Gas Association studying the effect of rates on water-flood performance.

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mulas of barrels per day per foot of sand. Probably the formulas allowed somewhat uniform injection pressures just below the formation breakdown pressure for the area concerned.

The formulas were then carried to other flood areas and applied or modified. Experience had developed them for one specific area. They were not valid in a new area and are not founded on any logical basis that can be discovered.

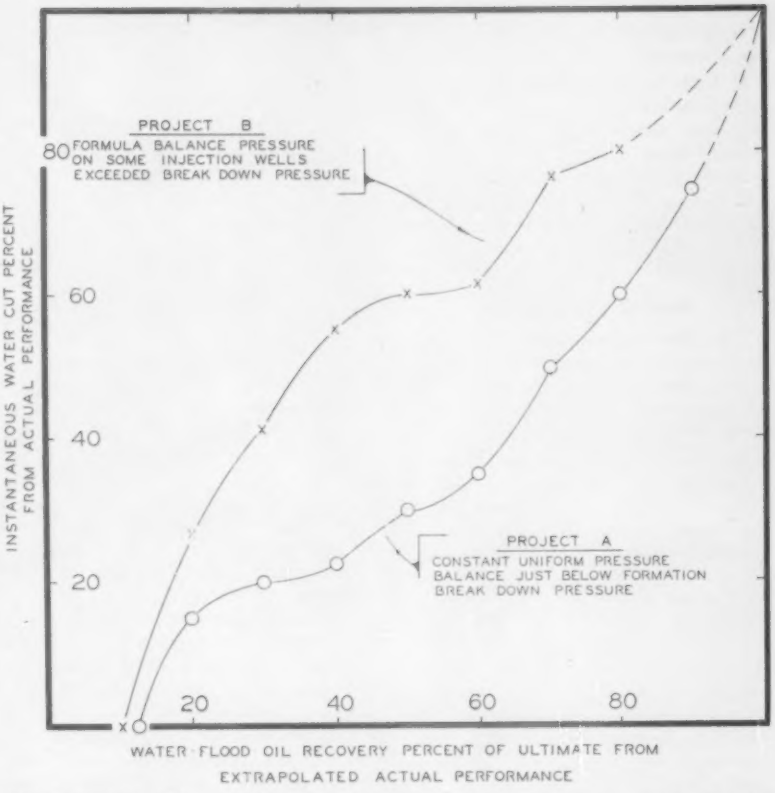
By the constant - uniform - pressure method, that is putting same injection pressure on all injection wells and permitting them to take what water they will, the formation will affect its own best balance.

A five-spot case . . . Fig. 4 indicates the performance of wells in a five spot using the two balance methods. Note that with the constant-uniform-pressure method the curves converge so that they reach a rate that is essentially uniform as compared with their performance during fillup. A constant uniform wellhead pressure will result in a uniform pressure on all permeability ranges of the sand which can be made maximum by going up to just below formation breakdown pressure.

Since a five spot constitutes a system with a great deal of control exerted by the capacity of the producing well, elements of equal permeability should tend to flood out uniformly and should form a self-balancing system. This will result in less water injected, less water produced, and greater ultimate recovery at the point where water-oil ratio makes the flood uneconomical as compared to other types of balance.

The formula method can result in bypassing due to exceeding the formation breakdown pressure in wells in a five spot that won't fit the formula. Also by not putting uniform pressure on all permeability ranges there is a tendency to compound the heterogeneity of the formation with regard to flow characteristics. This will result in lost ultimate oil due to increased water cuts and lower pressure differentials on some portions of the sand.

Lower water cut . . . Fig. 5 compares cut and recovery performance of two nearby Permian sand projects in Ward County, Texas. The projects had progressed to the point that reliable extrapolation of future water and oil-production rates could be made and they are believed to have similar reservoir characteristics. Complete data are not available to compare ultimate recovery on an acre-foot basis. However, project A appears the most efficient recoverywise from the data available and it also had the most efficient performance on the basis of water cut. Fig. 5.



COMPARISON of dimensionless cut and recovery performance for two nearby Permian sand projects. Fig. 5.

shows that less water will be processed, injected, and produced per barrel of oil recovery from project A as compared with project B.

Using core data . . . Theoretically the cut vs. recovery curve and therefore water and oil produced can be predicted approximately from core data. The principle involved is that the sands carry fluid proportional to their capacity (permeability and number of feet of sand). With sufficient permeability and mobility data, cut vs. recovery may be calculated. The more permeable sand portions flood out then carry water and so on to economic limit.

Calculations were made with limited core data. The calculated cut vs. recovery more closely traced the actual performance of project A and the deviation of project B is attributed to formula balance and bypassing.

It is presumptious to establish a theoretical procedure and blindly adhere to it in field operations. Although the pressure-balance method is believed to be the best general practice presently available for proper flood balancing, certain situations and conditions could warrant modification. Examples might be acute physical limitations of injection water quantity, certain very special individual well conditions, offset practices, and many others.

In any event proper operations demand detailed study and management on an individual well and pattern unit basis to insure a good flood balance and maximum recovery.

Production Practice

With regard to production practices, the operator has a range of choices between producing his wells at capacity by pumping to flowing his production. Most evidence available indicates that a greater ultimate recovery will be realized by capacity pumping of producing wells, and that flood life will be shorter.

Many of the same arguments that apply to high rates of injection apply here. High fluid levels in producing wells put a back pressure on the formation that decreases flood-out rates; thus leaving tighter sand unswept at flood abandonment. The other important argument for capacity pumping is pointed up in the literature where it was shown that oil would migrate out of closed-pattern floods in pilot operation if a back pressure was put on the producing wells. This argument holds also for the unenclosed edge area

around projects and fields and for any unswept area inside of a five spot at abandonment.

If wells are not produced at capacity, more oil will be pushed into this area than would occur if capacity operations were followed. Economics may in some cases alter these conclusions and certain floods may recover more economic reserves by flowing production during all or a portion of their project life.

General Considerations

The elements of a water-flood operation are finance, organization, acquisition, development, and operations. Rate practices affect directly or indirectly all of these elements.

Return on investment will be greatly affected by rate practices both in the ultimate gain to investment and in the time to pay out. Rates that are held artificially below the maximum possible for a project will result in a lower ultimate recovery and a longer flood-out period. This, in turn, results in increased total operating costs and greater depreciation and repair costs on equipment. At some point of lower rates the project will become unattractive from an investment standpoint and the secondary oil will not be recovered.

To be successful water flooding requires the best in organization and personnel. If the profit is reduced by artificial rate restrictions, there could be a tendency to attempt to save costs by using inferior personnel or only part of the time of competent personnel in the water-flood program. This is usually fatal to secondary recovery.

Projects that will not show a reasonable recovery and flood life will not be acquired or water flooded if already held. Low rates create such properties whether the restriction is natural or artificial.

Development will be affected in much the same manner as organizations. Ultimate-recovery-losing short cuts and practices will be followed in an attempt to hold development costs low on low-rate projects.

Loss of recovery . . . Rate practices affect operations and gain or lose ultimate recovery in the same way they affect organization and development. For comparative purposes, assume that per cent cut vs. per cent recovery is independent of rate and that performance will be the same for any rate. It should be understood that these assumptions are incorrect and that any rates below maximum possibly will result in less efficient performance. Giving lower rates this best possible performance, the following can be noted:

Recovery (%)	Water cut (%)	Fluids In and Out, bbl./day/five-spot: Input—250 Output—Oil	Output—Water	Input—63 Output—Oil	Output—Water
80	60	100	150	25	58
90	75	63	187	16	47
				Economic limit	
95	85	38	212	9	54
97	92	20	230	5	58
98	95	13	237	3	60
		Economic limit			
99	98	5	245	1	62

If a five spot that had a natural capacity for 250 bbl. per day was limited to 63 bbl. and the extremely favorable low-rate-performance assumptions are made, 5 or 6 per cent of the recoverable oil would be left when the well was making 10 bbl. of oil and 53 bbl. of water. This would be compared to only 1 to 1.5 per cent for the 250-bbl. rate at 10 bbl. of oil and 240 bbl. of water.

Operating costs are more a function of size of project, number of wells, and area of operations than of barrels-per-day production. Thus economic limit would be approximately the same in oil production per day for comparable 250 and 63-bbl. capacity projects. This means the lower rate will leave 4 or 5 per cent not recovered on the basis of the very favorable assumptions. Actually, the loss due to low rates could run 30 per cent to complete project failure.

Summary

The preponderance of information indicates that the greatest recovery and most favorable water-flood operations will be accomplished if:

1. Water is injected at rates that create a pressure on the formation just below where the formation breaks down.
2. That wells are produced by pumping at or near capacity.
3. No shutdown or reduction in injection or production occurs.

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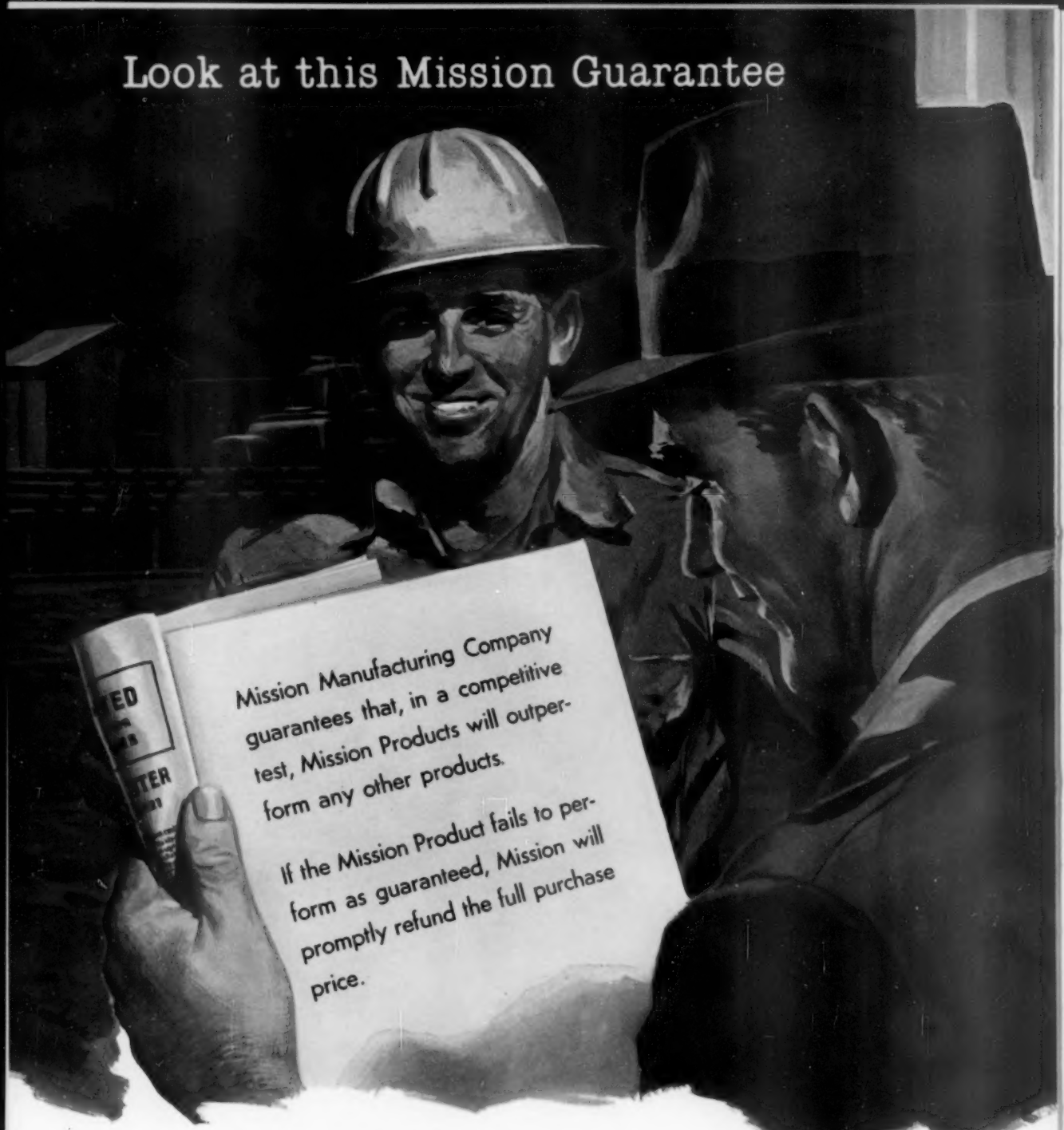
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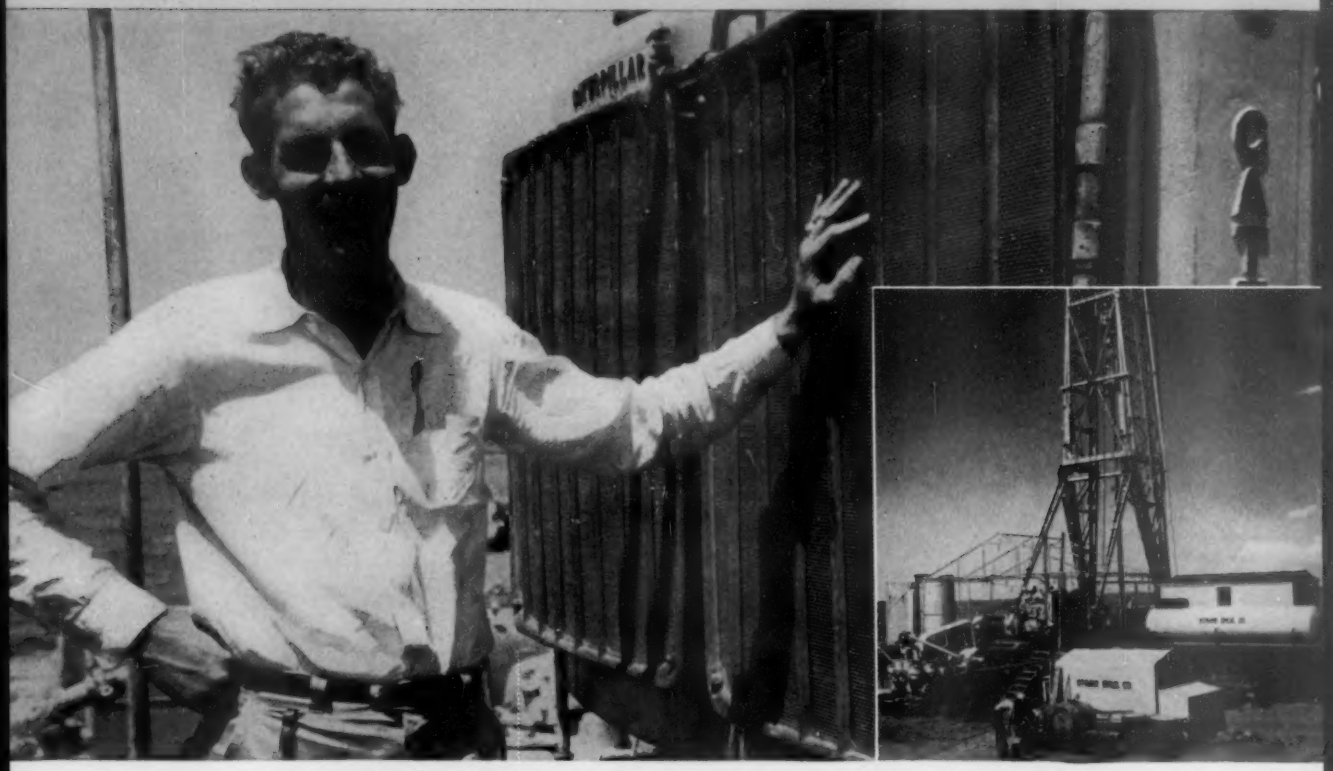

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MODERN HEAVY-DUTY OILFIELD ENGINES

What happens when you mix crude oil and light ends in pipeline?

by Ray J. Young and Sterling A. Callahan

Here's Cities Service's approach to the answers

Studies by Cities Service Research & Development Co. show that the physical property pattern of a mixture of crude oil and light ends varies considerably with the nature of the crude oil in the blend. For multicomponent mixtures no generalized correlation, based on some property of the individual components and applicable to all the physical properties, was discovered during the work.

However, after blend properties of several crudes are determined, they are useful in predicting properties of other crudes similar in gravity, viscosity, vapor pressure, type, etc.

The methods employed in this study and the resulting information are helpful in the design of new pipeline systems and in the modernization of existing facilities. Results show the way to maximum transportation savings through closer operational control. The study outlines a simple, rapid approach to individual crude oil-light ends blending problems.

IN recent years, the demand for light petroleum hydrocarbons in the Gulf Coast and Great Lakes areas for use in petrochemicals, in the manufacture of more volatile gasolines, and in the L.P.G. industry, has been increasing steadily. Fortunately, this demand has been offset by increased production of natural-gas liquids in the Mid-Continent area, and the big problem has been in devising a method of transporting the light ends to a more favorable market.

In solving this problem the oil industry has turned to the vast network of crude-oil pipelines spread over the central and southwestern portion of the country with the idea of blending light ends into crude-oil shipments and separating them by distillation at the refinery. This work was initiated in an effort to answer some of the many questions that arose concerning the physical properties of these pipeline mixtures.

The problem . . . Crude-oil systems are not usually fully enclosed. Tanks are allowed to float on the line and pumps vary in size and type, giving rise to pump suction difficulties. Therefore, the pipelines imposed vapor-pressure limitations on the material to be handled. It was also known that when light petroleum products are blended with crudes, the physical properties deviate considerably from those observed with ideal solutions.

This deviation made it impossible to calculate by ordinary methods the physical properties necessary to efficient pipeline operation and design. These physical properties include such things as vapor pressure, specific gravity, line pressure drop, viscosity, evaporation losses, etc. Another important phenomenon observed when mixing light ends with crude oil was that the solution volume was less than the sum of the individual components.

Considerable work had been reported by others on volume shrinkage in general and Childress and Grove,[1] reporting in a paper before the A.S.M.E. shortly after this work was begun, had derived generalized curves for predicting the magnitude of the phenomenon based on specific gravity differences of the products in binary mixtures.

For proposed long-range operating and design uses, however, it is necessary to be able to predict, with a relatively high degree of accuracy, all of these physical properties for two, three, and even four component mixtures.

Approach . . . The individual components can be classified roughly as crude oil, debutanized natural gasoline, butanes, and propane. For this study the crude classification can be broken down even further into the selected crudes from western Kansas, southern Oklahoma, and East Texas fields which were available for transporting light ends. The products from some five or six natural-gasoline plants were also involved and the nature of each stream varied from one plant to another.

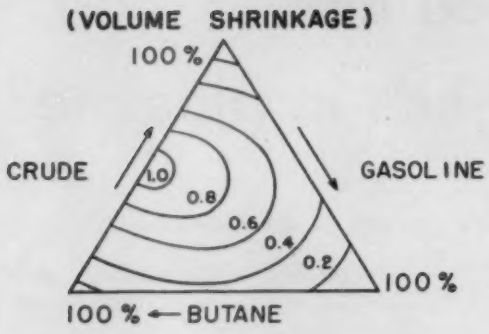
It was therefore decided that each blending point would be taken as a separate situation and that sufficient laboratory data would be accumulated to predict physical properties for any conceivable pipeline mixture at each site. If the data from the various sites exhibited sufficient homogeneity, or if the measured properties could be correlated to some characteristic of the components, then generalized presentation of the data would be derived. Upon completion of each phase of the laboratory study, field tests would be performed to verify the laboratory results.

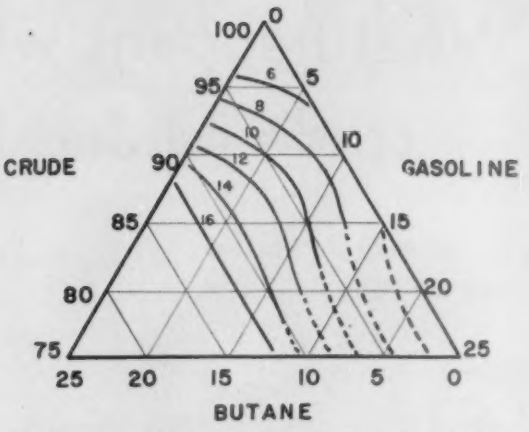
Experimental methods . . . The laboratory investigation involved hundreds of blends of crude oil, natural gasoline, butane, and propane. The individual components were measured gravimetrically into 1-l. steel bombs so that the compositions of the resulting mixtures were known very accurately. There was no vapor loss prior to removing the chilled samples from the bombs, and vapor loss during subsequent operations was kept to a minimum by keeping the bottles well stoppered below 32° F.

Reid vapor pressures were obtained by standard A.S.T.M. procedures.

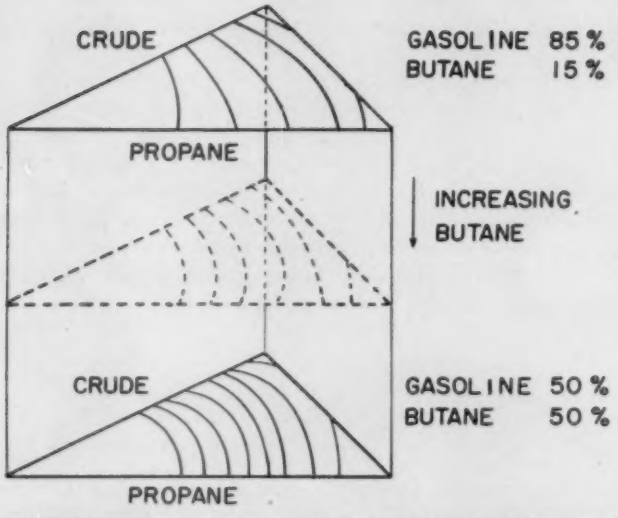
For the viscosity measurements, a Hoeppler viscosimeter was used. This instrument incorporates a sealed sample tube capable of containing the sample even at slightly elevated pressures. The tube is surrounded by a constant temperature bath and viscosities were determined at 50°, 68°, and 80° F. Samples having vapor pressures above atmospheric were charged to a high-pressure rolling-ball viscosimeter of the

Authors are with Cities Service Research & Development Co., Process Research Laboratory, Lake Charles, La. Paper presented at American Chemical Society meeting, Atlantic City, N. J.

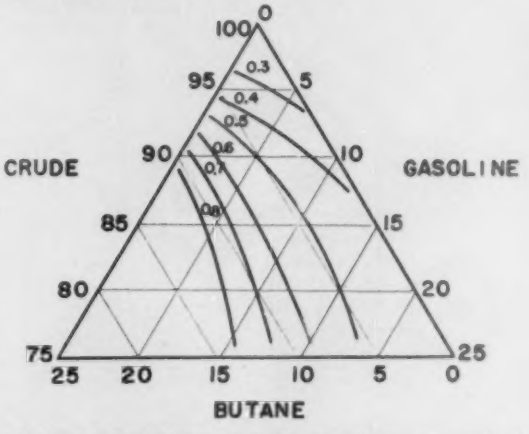




REID-VAPOR-PRESSURE ISOBARS for blends of Hewitt crude, natural gasoline (butane free), and total butane. Components are described in Table 1. Fig. 2.



VOLUME-SHRINKAGE data are correlated using these graphical methods. Upper diagram is for three components and lower diagram is for four components. Fig. 1.



LINES OF CONSTANT SHRINKAGE (volume per cent) of total unblended components for mixtures of Hewitt crude, natural gasoline, and total butane. Fig. 3.

type commonly used in reservoir fluid analysis work. (Ruska Cat. No. 1600.)

Specific gravities were determined in a pressure hydrometer with the exception of the high-vapor-pressure samples which were charged to a high-pressure pycnometer. Volume shrinkages expressed as a percentage of the total volumes of all unblended components, were calculated by the following equation:

$$\text{Per cent V. S.} = 100\left(1 - \frac{\text{Calculated specific gravity}}{\text{Observed specific gravity}}\right)$$

Partial A.S.T.M. distillations were also made for use in estimating evaporation and handling losses in the field.

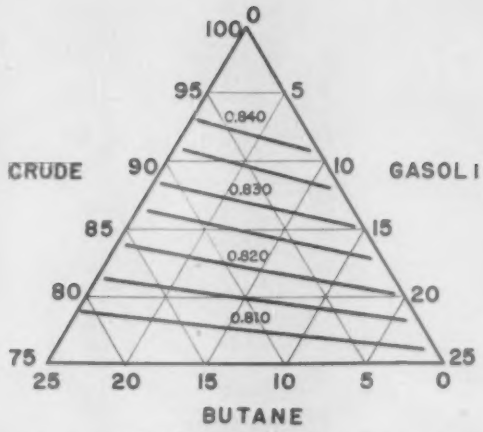
Presentation of data . . . In designing the experimental work, one of the major problems was the presentation of the data in a form readily usable to pipeline and gasoline-plant engineers. The changing field conditions as to component volumes precluded pursuing the work on a case basis and the presence of three, and in some instances four variables, complicated the picture even further.

The final solution of the problem can be shown schematically in Fig. 1. The upper portion of the figure is a typical ternary diagram showing the pattern characteristic for volume shrinkage of the system: crude oil, debutanized gasoline, and butane. It can be seen that at each corner of the triangle, representing 100 per cent of each component, the per cent volume shrinkage is zero and that shrinkage increased toward some point on each side of the triangle.

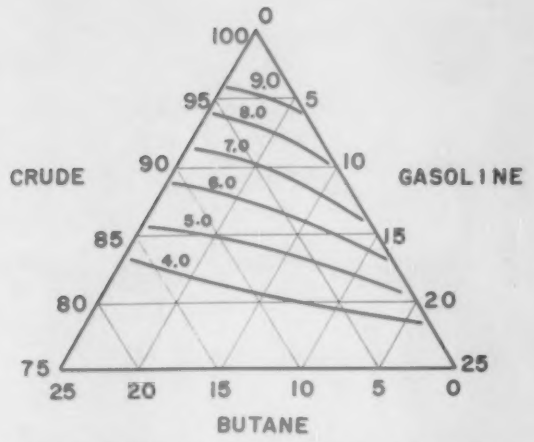
For any other physical property, the corners represent the value for the pure component. Since most interest lies in blends containing a minimum of 75 per cent crude oil, only the upper 25 per cent of the triangle is of importance in this work. The diagrams were prepared by plotting the values determined from a series of blends of constant gasoline concentration while backing out crude with butane, since most lines of constant property would be oriented at approximately right angles to the constant gasoline lines.

Contours were then drawn through the values of equal magnitude. Such diagrams were derived for each of the physical properties concerned.

Four components . . . The lower portion of Fig. 1 shows the solution to the problem of presenting data for blends of four components. The schematic three — dimensional figure represents a stack of diagrams having four components but varying in the ratio of butane to gasoline. The gasoline-butane mix has been treated as one component since natural gasoline is



LINES OF CONSTANT SPECIFIC GRAVITY for mixtures of Hewitt crude, natural gasoline, and total butane. Fig. 4.



LINES OF CONSTANT VISCOSITY (centipoise) for mixtures of Hewitt crude, natural gasoline, and total butane. Fig. 5.

usually produced in varying butane concentrations.

To use the diagram in predicting some physical property of a given blend the user must plot the value obtained from several triangles at the given crude-oil and propane concentration against the gasoline-butane ratio for each triangle. Then the value can be interpolated from the plot at the given gasoline-butane ratio.

Typical Operation

A typical operation in the Oklahoma area can be used as an example. Table 1 shows the properties of the components being blended for pipeline shipment in that area. It must be stressed that the 9 per cent butane present in the gasoline has been calculated out and added to the total butane in the triangular plots that are shown herein. The triangles, therefore, show butane-free gasoline, and total butane rather than the actual light components described. The crude oil is plotted on an as is basis.

Fig. 2 shows the Reid vapor pressures of a wide range of blends of Hewitt crude and the products of a large natural-gasoline plant as described in Table 1. As an indication of the unpredictability of these blends, it can be seen that in the range of 10 to 20 per cent gasoline content, the addition of gasoline to the blend while keeping butane content constant actually lowers the vapor pressure of the mixture.

In that area of the triangle, butane content can be increased without exceeding vapor-pressure limitations simply by adding gasoline and butane. In quantities less than 10 per cent, the vapor pressure increases with the gasoline content as would be expected.

Volume change . . . Fig. 3 is a similar diagram showing the volume changes on blending the same components. Shrinkage in this composition range does not exceed 1 per cent of the sum of the unblended components. Since the pipelines are allowed varying percentages of loss in handling crude shipments, information from this type of diagram may possibly result in adjustment of loss allowables in some areas.

The diagram in Fig. 4 enables the engineer to predict the specific gravities of mixtures in advance. These data plus viscosities obtained from Fig. 5 permit the calculation of line pressure drops per mile. The prediction of blend viscosities which is always difficult with petroleum components is easily accomplished with the diagrams. They are being used in designing new facilities with optimum line sizes, pumps, and pump-station spacing to take advantage of reduced viscosities.

The tabulation of all data necessary to the preparation of these multicomponent diagrams is to voluminous for inclusion here, but to give an idea of the precision attained Table 2 lists the experimental results obtained for blends at a single debutanized gasoline level (3.9 per cent).

Field test . . . Upon completion of the laboratory work, field tests were made to verify the accuracy of the diagrams under actual pipeline operating conditions. The results of one of these tests are shown in Table 3. The close agreement of the Physical Properties predicted from laboratory data and those observed in the field is readily apparent in comparing the two columns on the right.

The difference in pressure drop in psi. per mile between the crude and the mix is an indication of horsepower savings due to viscosity reduction.

TABLE 1—PHYSICAL PROPERTIES OF TYPICAL UNBLENDED COMPONENTS (SOUTHERN OKLAHOMA)

Component—	Viscosity Cp.-68° F.	Specific gravity	R.v.f.	iC_4	nC_4	C_5 and heavier
Hewitt crude	7.0	0.855	3.9	0	0	...
Natural gasoline	...	0.654	18.0	2.7	6.3	91.0
Butane	...	0.582	44.0	25.0	70.0	5.0

TABLE 2—PROPERTIES OF A SERIES OF BLENDS OF HEWITT CRUDE, NATURAL GASOLINE AND BUTANE AT THE 3.9 PER CENT GASOLINE LEVEL

Blend No.	Crude per cent	Nat. gaso. (C_4 free) per cent	Total butane per cent	Viscosity Cp. 68° F.	R.v.p. psi.	Sp. Gr. 60° F.	Shrinkage vol. of unmixed components
1	95.2	3.9	0.9	9.45	5.4	0.847	0.27
2	91.9	3.9	4.2	7.40	9.3	0.840	0.47
3	89.1	3.9	7.0	6.42	11.0	0.833	0.57
4	86.3	3.9	9.8	5.65	13.7	0.827	0.73
5	83.9	3.9	12.2	4.60	16.6	0.821	0.77

TABLE 3—COMPARISON OF LABORATORY AND FIELD TEST

	Hewitt crude	Mixtures Lab.	Mixtures Field
R.v.p., psi.	3.9	13.0	13.1
Viscosity, Cp., 80° F.	7.0	3.5	3.4
Gravity, °A.P.I.	35.3	42.1	42.3
Pressure drop, (psi./mile) 60° F.	7.8	5.8	5.6
Volume shrinkage per cent unmixed components	...	0.6	...
Evaporation loss, per cent at 80° F.	0.1	0.3	...

Reference

1. Childress, H. M., and Grove, M. B., Volume Shrinkage Occurring in Blending Petroleum Products and Produced Distillates with Crude Oils, The Oil and Gas Journal, November 21, 1955, page 178.

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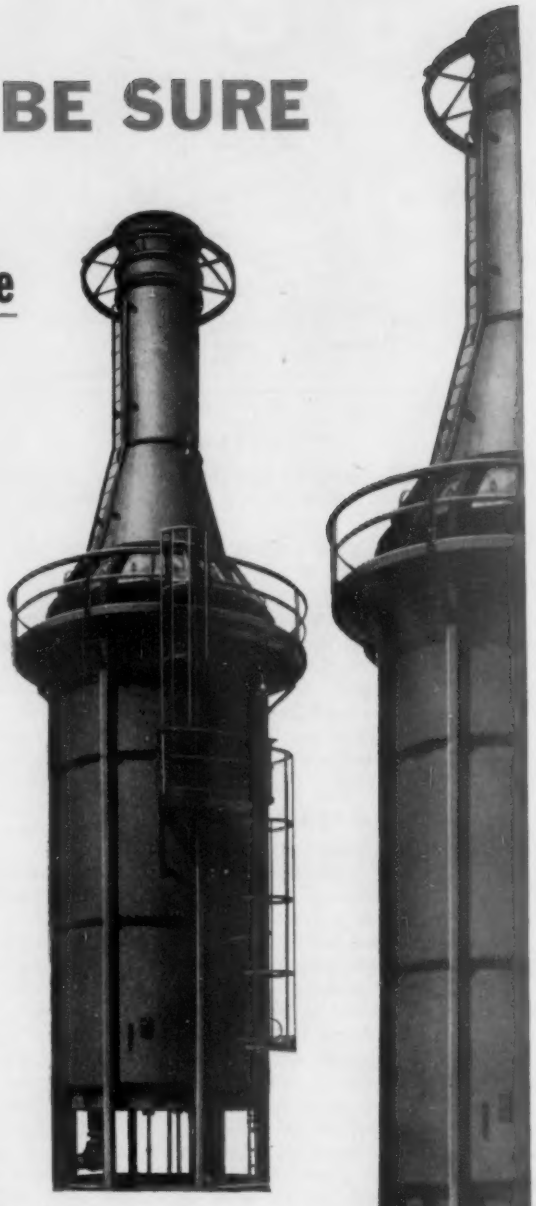

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How to Determine True Resistivity

by Dr. R. G. Hamilton and Paul Charrin

FIG. 1 (Part 1) illustrates the situation existing around a borehole filled with mud. The diagram shows the media, usually of unlike resistivities, involved in the measurement of resistivity by a system of electrodes placed in mud opposite a bed. Measured resistivity, R_a, is a function not only of R_t, the true resistivity desired, but also of d, R_m, R_s, e, D_i, R_i and spacing length The apparent resistivity recorded on the log must be corrected for the influence of the other media in order to obtain R_t, the true formation resistivity.

The authors are, respectively, head of Hamilton Well Log Consultants, Tulsa, and president of Perforating Guns Atlas Corp., Houston.

Precalculated resistivity correction curves, sometimes called departure curves, are employed to make the corrections. A large number of curves for various combinations of e/d, R_i/R_m and D_i/d are required in conventional departure curves.

Infinite thickness curves are available and may be used for $e \geqq 6 \times AM$ and $e \geqq 3 \times AO$. Finite thickness curves are available for thinner formations.

P.G.A.C.'s simplified correction curves are presented in Charts 6 and 7. Simplified presentation has served to reduce the number of charts usually employed.

A short electrode spacing is required to log thin beds, but the depth of investigation of a short spacing is shallow and the apparent resistivity recorded is a function of R_i and D_i in invaded beds. Therefore R_t cannot generally be obtained from short spacings in invaded formations.

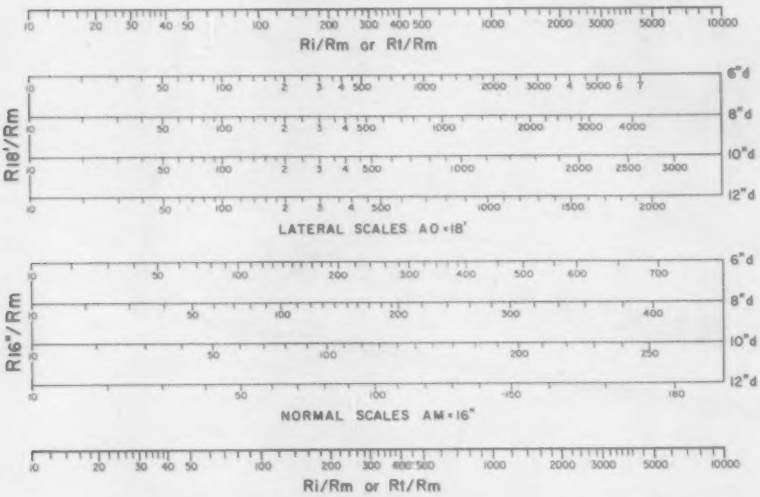
A long electrode spacing, having much greater depth of investigation, is required to obtain R_t of the uncontaminated formation beyond the invaded zone. The longer spacings have the disadvantage of presenting distorted curves and very low apparent values when logging thin beds. A thin bed is one whose thickness approaches the length of the electrode spacing.

Because short spacings are required to log thin beds and long spacings are required to determine R_t, a conventional electric log has several resistivity curves using different electrode spacings. Additional resistivity curves are always useful in solving a problem.

P.G.A.C. is able to record as many as four resistivity curves simultaneously. The curves and spacings employed are designed to solve the special problems in each logging province.

The solution . . . The P.G.A.C. Gulf Coast electric log includes 16 and 64-in. normals and 8 and 18-ft. lateral curves. In this area invasion appears negligible or nonexistent and R_t is easily obtained from the 64-in. normal or 8-ft. lateral curve. For thick beds that are invaded the 18-ft. lateral value is corrected by Chart 6. Also the 16 and 64-in. normal curves corrected by P.G.A.C.'s normal correction curves, may be employed to determine R_t.

The P.G.A.C. Mid-Continent electric log includes the 16, 38, and 64-in. normal curves and the 18-ft. lateral curve. In this area, where invasion is often deep, the 18-ft. lateral is used to determine R_t in thick formations. Chart 6 makes the corrections. Many thin, invaded, resistive beds occur in the Mid-Continent. The 18-ft. lateral curve will obtain an approximation of R_t in these thin beds but a more precise evaluation



Place rule across R18'/Rm value on appropriate Lateral d" scale. Read Rt/Rm top or bottom scale.
Place rule across R16"/Rm value on appropriate Normal d" scale. Read Ri/Rm top or bottom scale.

EXAMPLES: R18'/Rm = 1000, d = 8" Read Rt/Rm = 610
R16"/Rm = 100, d = 8" Read Ri/Rm = 125

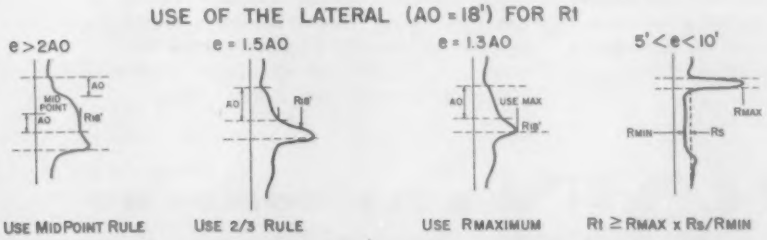


Chart 6—Corrects short normal and lateral curves for thick beds. Parameters are hole diameter. Results are R_i and R_t. When $R_{16''}/R_m > 50$, $R_{18'}$ values must be corrected for borehole effect.

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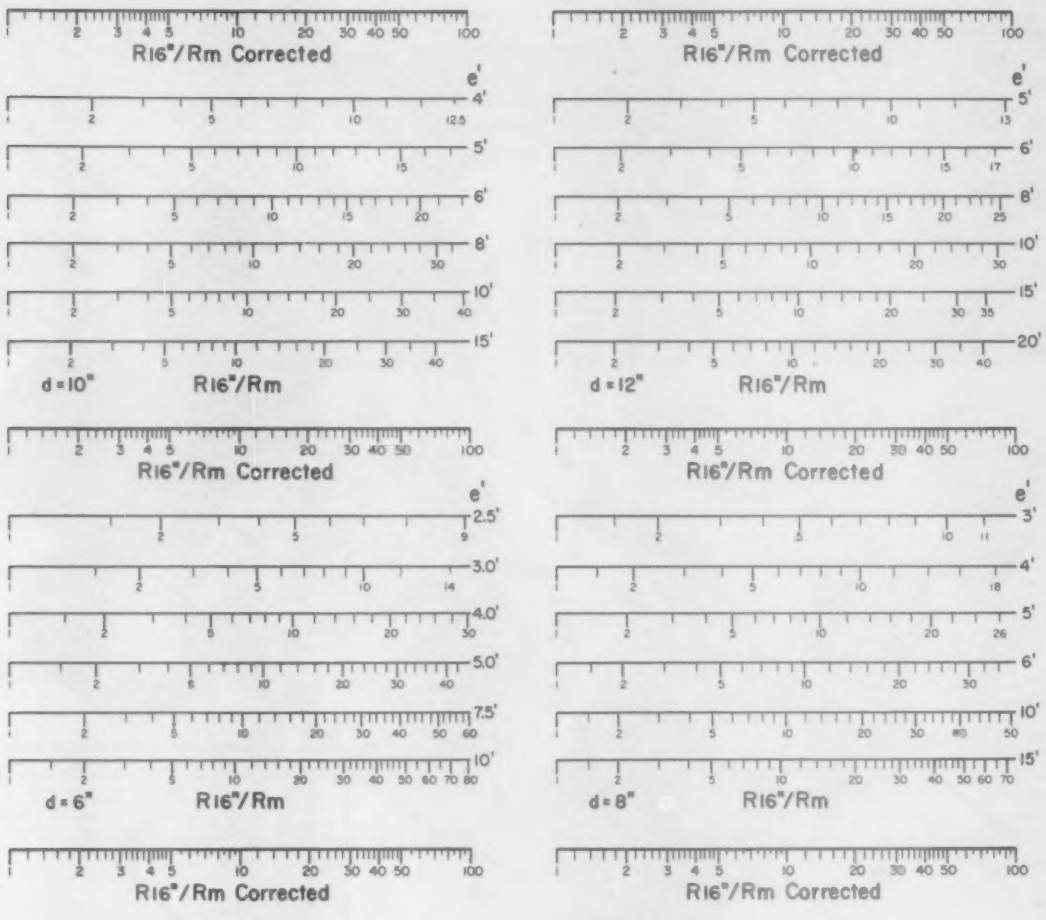

Determine $R_{16"}/R_m$ for bed under study
Determine e' from 16" curve.
Select appropriate hole diameter chart
Place rule vertically through $R_{16"}/R_m$ value on e' Line.
Read $R_{16"}/R_m$ corrected, top or bottom scale.

EXAMPLE: d = 8", e = 5', $R_{16"}/R_m$ = 20
Select d = 8" chart.
Place rule vertically through $R_{16"}/R_m$ = 20 on e = 5' Line.
Read $R_{16"}/R_m$ corrected = 42, top or bottom scale.

THE CORRECTED VALUE IS R_i/R_m WHEN THE BED IS INVADED
THE CORRECTED VALUE IS R_t/R_m WHEN THE BED IS NOT INVADED.
FOR VERY SLIGHT INVASION THE CORRECTED VALUE IS CLOSE TO R_t/R_m.

Chart 7—Corrects 16-in. normal for thin beds. Use when (1) $R_m \cong R_s$, or (2) $R_t > 7R_s$ for bed thickness greater than 6 ft., or (3) $R_t > 10R_s$ for bed thickness less than 6 ft.

of R_t may be obtained using the three normal curves. This procedure will be shown in the next part of this series.

Chart 7 corrects the apparent resistivity of the 16-in. normal curve for thin beds. Because the short spacing usually investigates the invaded or partially invaded zone about the borehole, the corrected value is called R_i. In non-invaded beds, the corrected value is actually R_t. The R_i value usually lies between R_{xo} and R_t or close to R_{xo}.

R_t from the lateral (AO) curve

Resistive beds: Follow instructions on Chart 6 for the 18-ft. lateral.

Conductive beds: Select R_s from the optimum value in thick beds, from the lower part of thin beds. The 8-ft. lateral may be used in the Gulf Coast to read R_s in beds that are not invaded or only slightly invaded.

R_t from the 64-in. normal in beds of low resistivity

($R_{16"}/R_m \leq 10$, invasion 2d or less)

Bed thickness—	Conditions for use	R_t estimation
e > 4 AM		$R_t = R_{64"}$
e ≈ 3 AM	$R_m \approx R_s$ $R_{64"}/R_s \geq 2.5$	$R_t = 1.5\ R_{64"}$
e ≈ 3 AM	$R_m \approx R_s$ $R_{64"}/R_s \geq 1.5$	$R_t = R_{64"}$
e ≈ 2 AM	$R_m \approx R_s$ $R_{64"}/R_s \geq 2.5$	$R_t = 2\ R_{64"}$
e ≈ 2 AM	$R_m \approx R_s$ $R_{64"}/R_s = 1.5$	$R_t = 1.5\ R_{64"}$

Correction of the 16-in. normal for R_m, d and electrode characteristics

Follow instructions on Chart 6 for thick beds, Chart 7 for thin beds.

For convenience of nomenclature the corrected value is called R_i/R_m. The corrected value may be close to R_t/R_m when R_i/R_m is less than 10.

R_i/R_m is employed for correction of the ASP, for determination of porosity from the 16-in. curve in deeply invaded rocks and in connection with resistivity correction curves for the determination of R_t. **End.**

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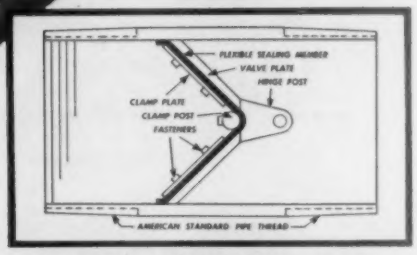

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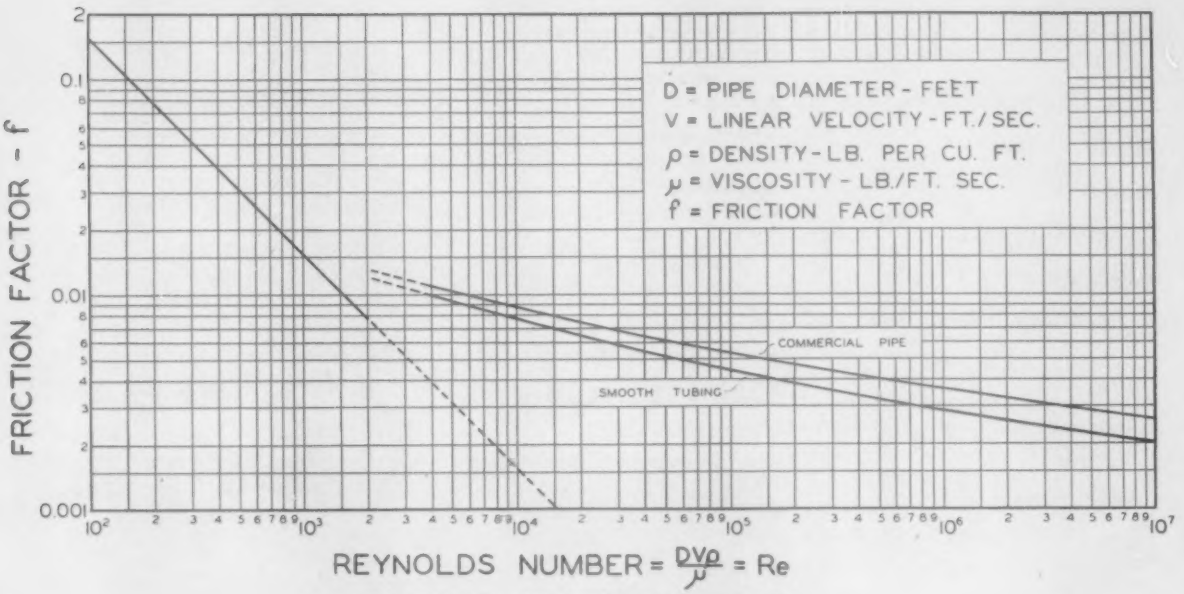
D = PIPE DIAMETER - FEET
V = LINEAR VELOCITY - FT./SEC.
ρ = DENSITY - LB. PER CU. FT.
μ = VISCOSITY - LB./FT. SEC.
f = FRICTION FACTOR
COMMERCIAL PIPE
SMOOTH TUBING
FRICTION FACTOR - f
REYNOLDS NUMBER = DVρ/μ = Re

Fig. 1—Working chart for determining pressure drop.

ELEMENTS OF FIELD PROCESSING—28

Calculating Pressure Drop

by Dr. John M. Campbell

An equation:

$$V(P_2 - P_1) = -\frac{2fLv^2}{gD} - \Delta X$$

or

$$\Delta P/\rho = \Delta P_f/\rho - \Delta X$$

has been developed (Part 27) which enables one to calculate the pressure drop between any two points in a liquid system, said section containing no device to add or remove work. This equation may only be used, however, if the value f, called the friction factor, may be evaluated.

The application of dimensional analysis to experimental data has shown that f is a function of the dimensionless group Dvp/μ which is commonly known as Reynolds number or modulus (Re). The relationship between f and Re depends primarily on the roughness of the pipe wall and type of flow obtained. Although many combinations of these are possible the curves shown in Fig. 1 represent an excellent correlation.

Type of flow . . . Where Re is less than 1,000 the flow is laminar whereas above 4,000 it is turbulent. The zone in between is a transition region in which no good correlation exists but the use of the turbulent flow curves is recommended for they give conservative results.

Author is chairman, School of Petroleum Engineering, University of Oklahoma, Norman.

Detail friction-factor curves are available which show the friction factor as a function of the pipe roughness. For most engineering uses, however, this degree of accuracy is somewhat misleading, particularly in lease processing work. The curves shown in Fig. 1, therefore, are recommended for those problems involving the calculation and design of gathering systems on oil leases and similar installations.

The approximate equations of these lines are:

$$Re < 1{,}000,\ f = 16/Re \qquad (1)$$

$$Re > 1{,}000,\ f = 0.04/Re^{0.194} \text{ for smooth tubing} \qquad (2)$$

$$Re > 1{,}000,\ f = 0.04/Re^{0.172} \text{ for commercial pipe} \qquad (3)$$

Although no exact criteria exist for differentiating between smooth tubing and commercial pipe, Equation 3 would normally be used for all new pipe 8 in. and less nominal diameter and all used pipe that had evidence of scale and corrosion.

Example . . . An 8-in. crude-oil line, 17 miles long, handles per day 40,000 bbl. of 40° A.P.I. oil with a viscosity of 9.5 cp., and discharges to atmospheric storage which is 300 ft. higher than the pump discharge. Determine the pump discharge pressure.

Solution:

$$40°\text{ A.P.I.} = \frac{141.5}{131.5+40} = 0.824 \text{ sp. gr.}$$

$$= 51.4 \text{ lb./ft.}^3$$

$$9.5 \text{ cp.} = (9.5)\ (0.000672) = 0.00638 \text{ lb./ft.-sec.}$$

$$Q = \frac{(40{,}000)\ (5.61)}{(3{,}600)\ (24)} = 2.6 \text{ cu. ft./sec.}$$

$$D_{8"} = 8.08 \text{ in.} = 0.673 \text{ ft.}$$

$$v_{8"} = \frac{2.6}{0.355} = 7.32 \text{ ft./sec.}$$

$$Re = \frac{(0.673)\ (7.32)\ (51.4)}{0.00638}$$

$$= 3.98 \times 10^4$$

From Fig. 1, f = 0.0065.

Therefore:

$$\Delta P_f = \frac{2fLv^2\rho}{gD}$$

$$= \frac{(2)\,(0.0065)\,(17)\,(5{,}280)\,(7.32)^2\,(51.4)}{(32.2)\,(0.673)}$$

$$= 148{,}300 \text{ lb./ft.}^2$$

$$\Delta X = (51.4)\,(300) = 15{,}400 \text{ lb./ft.}^2$$

Therefore:

$$[(14.7)\,(144)] - P_1 = -148{,}300 - 15{,}400;$$

$$\text{or } P_1 = 148{,}300 + 15{,}400 + 2{,}120$$

$$= 165{,}820 \text{ lb./sq. ft. abs.} = 1{,}151 \text{ psia.}$$

$$= \mathbf{1{,}136 \text{ psig.}}$$

A convenient equation may be developed for oil lines using Equation 3 above. If B = oil flow rate in bbl./day and d = internal pipe diameter expressed in inches:

$$v = 0.286\ B/d^2$$

$$f = \frac{0.04}{Re^{0.172}}$$

$$= \frac{0.04}{(d/12 \times \rho/\mu \times 0.286\ B/d^2)^{0.172}} \quad (4)$$

Then:

$$\Delta P_f = \frac{2fLv^2\rho}{gD}$$

$$= 1{,}470 \frac{LB^{1.828}\ \rho^{0.828}\ \mu^{0.172}}{d^{4.828}} \quad (5)$$

when the value of f from Equation 4 is substituted into the above equation and the result consolidated. The number of significant figures shown for the exponents result from the derivation and do not reflect the accuracy. For practical purposes these numbers may be rounded off to two significant figures.

Hazen-Williams Formula

The Hazen-Williams formula is an empirical equation that was originally developed for the flow of water. Like many such equations it contains an arbitrary constant for which a value is necessary. It has been used successfully for oil-line design where sufficient actual data were available to estimate a value of the constant C.

In common engineering terms this equation may be written as:

$$Q = 0.67\ CD^{2.63}\ (\Delta P/\rho L)^{0.54} \quad (17)$$

Where:

Q = flow rate, ft.^{3}/sec.
D = diameter, ft.
ΔP = pressure drop, lb./ft.^{2}
L = length, ft.
ρ = density, lb./ft.^{3}

The arbitrary constant C is primarily dependent on surface roughness but is also affected by pressure drop and diameter for the exponents used for these values usually differ slightly from the actual ones obtained.

Saph and Schoder Formula

This is another empirical equation that has sometimes been used to design water systems. It is usually written as:

$$h = 0.38 \frac{v^{1.86}}{D^{1.25}} \quad (18)$$

Where:

h = friction loss, ft. water per 1,000 ft. pipe
v = velocity, ft./sec.
D = internal diameter, ft.

The limitations of the above two empirical equations are obvious and their use cannot be generally recommended. However, where sufficient data and know-how are available they can give satisfactory results.

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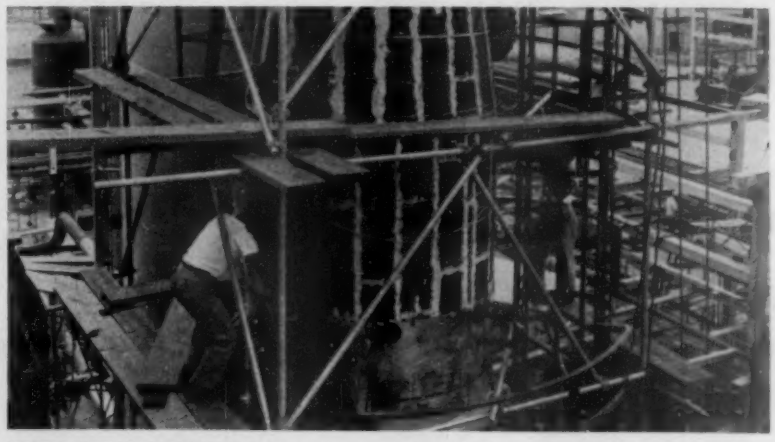

SHEET-METAL JACKET being applied over pointed blocks on a column in the atmospheric group at Tidewater's Delaware refinery.

Mineral wool used as . . .

Tidewater Insulates Refinery

by E. L. Waller* and H. L. Humes†

THE trend of petroleum-processing units towards higher and higher operating temperatures increases the importance of thermal insulation. Because of the vital role which insulation on equipment and piping plays in the prevention of costly heat loss and the maintenance of correct process temperatures, its selection and design merit careful consideration.

At the largest single refinery construction project ever undertaken, Tidewater Oil Co.'s new Delaware Flying A refinery near Delaware City, Del., over 750,000 board feet of mineral-wool block insulation are used. The basis for determining the insulation requirements is the normal operating temperature. At the new Delaware Flying A refinery all surfaces above 150° F. are insulated for heat conservation, for personnel protection and for temperature control.

Surfaces with operating temperatures from 75° to 150° F. are insulated only where unusually close operational temperature control is necessary. Below 75° F. surfaces are insulated only where required for temperature and condensation control.

Piping and equipment (with only six exceptions) normally operating above 150° F. is insulated for personnel protection to a height of 7 ft. above the operating level. The exceptions are hot pump cases, coolers, turbines, con-

*Senior engineer, C. F. Braun & Co. at Alhambra, Calif., and †vice president in charge of research and development, Baldwin-Hill Co. at Trenton, N. J.

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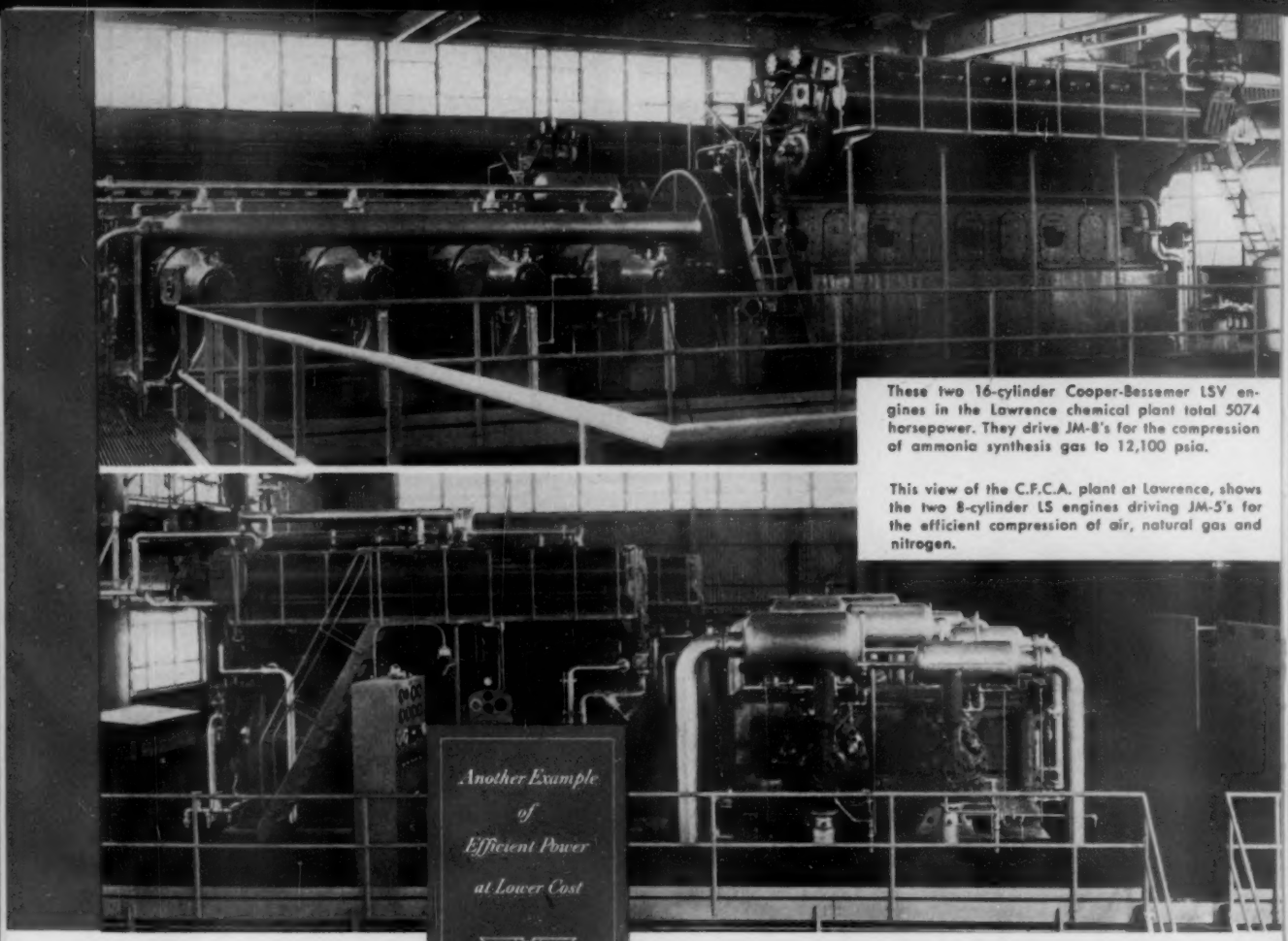

These two 16-cylinder Cooper-Bessemer LSV engines in the Lawrence chemical plant total 5074 horsepower. They drive JM-8's for the compression of ammonia synthesis gas to 12,100 psia.

This view of the C.F.C.A. plant at Lawrence, shows the two 8-cylinder LS engines driving JM-5's for the efficient compression of air, natural gas and nitrogen.

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Cooper-Bessemers at C. F. C. A.'s Lawrence Plant UNIQUE! IN SIZE IN PERFORMANCE IN ECONOMY

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Similarly, the plant contains two LS-8 engines, rated 1852 hp at 330 rpm, combined with JM-5's for the compression of three separate gases on three individual services . . . air from 120 psia to 630 psia, natural gas from 115 psia to 430 psia and nitrogen from 35 psia to 330 psia.

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Material Selection

Low conductivity over a wide range of surface temperatures is considered especially desirable. The ability of one basic insulating material to cover surfaces operating at many different temperatures simplifies purchasing and warehousing, and, usually precludes the necessity for stocking special high-temperature insulations.

A relatively high degree of structural strength also is important. For this reason rigid block type of insulation, rather than the more flexible types, is considered superior, because today the added labor cost of adequately supporting flexible type of insulations more than offsets any saving in material cost. The insulation should be resilient in order to fit snugly the surface to which it is applied, and to adjust itself to a limited amount of thermal expansion. Resistance to abrasion also is desirable so that the material may be salvaged if removed for maintenance of the vessel.

A final, but by no means less-important criterion, is ease of both handling and application, since erection costs exceed material costs by approximately 50 per cent.

A felted block type of insulation manufactured from spun mineral fibers was selected to insulate all surfaces operating at temperatures above 600° F. In addition, it was applied on all insulated flat surfaces and all cylindrical surfaces greater than 24 in. in diameter in the temperature range 150° to 1,700° F.

Combining low thermal conductivity (for instance, .51 B.t.u., in./hr., sq. ft., °Fahrenheit at 600° F.) and a wide temperature range (to 1,700° F.) with excellent structural strength, resilience, abrasion resistance, comparatively low moisture absorption and low alkalinity this material meets the desired criteria. Lightweight and easily cut with a knife or saw, it is simple to handle and apply. It conforms readily to irregular and curved surfaces.

In addition it is available in thicknesses from 1 to 6 in. and in a wide range of standard sizes up to 24 by 36 in. Thus, because it is easily shaped, only the larger sizes need be stocked. Smaller sizes can be cut from large blocks in the field as required.

Thickness . . . Insulation, except that applied merely for personnel protection, should pay for itself, either in B.t.u.'s saved or in maintaining temperature control during extreme weather conditions. At the Tidewater project, calculation of insulation thicknesses was based on normal-operating surface temperatures and a 4-year payoff life.

Cost of heat was estimated at 25 cents per million B.t.u.; cost of applied insulation at 26 cents per board foot. Mean ambient temperature was assumed to be 50° F., and average wind velocity as 15 m.p.h. Block thicknesses determined in this manner are shown in Table 1.

Weatherproofing . . . Basically, two methods were employed to weatherproof tank and vessel insulation. Plastic weatherproofing was used on small apparatus and exchangers and on the bottom heads of large vertical cylinders and columns. With minor exceptions, sheet-metal jackets protect insulation on the tops and sides of large horizontal and vertical vessels and tanks.

Either roofing paper or sheet metal covers most pipes and lines, while roofing felts weatherproof the tops of the A.P.I. storage tanks.

Small Equipment

Appropriate thicknesses (see Table 1) of 6 by 36-in. mineral-wool block insulate all apparatus and exchangers having radii of from 13 to 30 in. For equipment with radii greater than 30 in., 12 by 36-in. blocks were used.

Adjacent blocks were applied with staggered joints, butted tightly together. To fit the smaller diameter, units blocks were field cut and scored on inner surfaces. Elastic bands composed of ropes and springs or of rubber strips tied together, held the blocks initially until utility wire was wrapped around the vessel to secure them temporarily. Finally the block was permanently secured by ¾ by .022-in. stainless-steel expander strap, 5-ft. corrugated and 5-ft. plain, sealed with closed type of seals and the utility wire was removed.

At manholes, large nozzles, support brackets, and on vessel heads, securement with expander strap is impractical. Here studs were welded to the vessel surface. A web of 14-gage tie wire, fastened to the studs, secures the block. Interrupted expander straps also are anchored to the tie wires.

After the block was secured, all joints, cracks, and bruises were pointed with a white mineral-wool insulating-finishing cement. Then the cement was applied over the entire surface in a single ½-in. layer and finished with a slightly rough outer face.

Reinforcement of the subsequent layer of plastic weatherproofing was accomplished by laying wire mesh over the cement coat. The mesh was attached with ⅞ by 2-in. galvanized iron staples driven through the cement into the mineral-wool block. Sides and ends of adjacent mesh sections were interwoven.

First step in weatherproofing apparatus and exchangers was the application of a filler coat of plastic weatherproofing compound over the cement and mesh. The filler coat consisted of two parts No. 20 dry, washed sand and four parts by weight of asphaltic mastic weatherproofing. Then a finish coat of mastic alone was applied.

Application of multilayer block insulation on small apparatus and exchangers was very similar to that of the single layer just described. However, the inner layer of block was secured with 14-gage galvanized iron wire on 8-in. centers instead of expander strap, and only bruises—not joints—in the inner layer of block were pointed with mineral-wool cement.

The outer layer, its joints staggered with respect to those of the inner layer, was then applied and secured with expander strap.

Large units . . . The larger vessels, tanks and columns at the Delaware refinery are insulated with spun mineral-wool blocks in the same way as the smaller equipment, with the addition of expansion joints. Columns wth radii from 13 to 60 in. were insulated with 6 by 36-in. blocks. Those greater than 60 in. in radius were covered with 12 by 36-in. blocks.

Longitudinal spacing of these units of insulation is accomplished by welding a continuous ring of steel angles around the vessel shell at intervals along the vessel length. Minimum ring spacing is 9 ft. Maximum angle-support spacing is 15 ft. except on A.P.I. storage tanks.

Insulation on the heads of vessels is secured with a combination of welding studs, tie wires and circumferential expander strap. Blocks were field cut to conform to the shape of the surface and pointed.

TABLE 1—INSULATION THICKNESS SCHEDULE, MINERAL-WOOL BLOCK ON APPARATUS AND TANKS

Temperature range degrees F.	Thickness, (in.) Temperature control, heat conservation	Thickness, (in.) Personnel protection only
150-299	1½	1
300-399	1½	1½
400-499	2	1½
500-599	2	1½
600-699	2½	1½
700-799	2½	2
800-900	*3	2
900-1,000	*3	2½
1,000-1,100	*3½	2½

*Double-layer insulation, first layer, 1½ in. thick.

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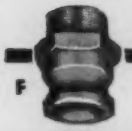

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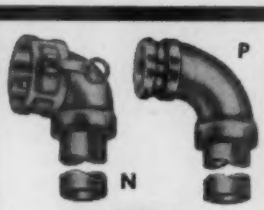

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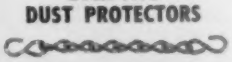

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Corrosion of Ferrous-Metal Tubing—3

Sulfide Attack Requires Modern Weapons

by Thomas M. Krebs

THE tubes were corroded quickly intergranularly by the sulfurous acid. They had been stress relieved at 1,560° F. and slow cooled after bending by the fabricator to get around stress-corrosion cracking problems found previously in the unit. This example shows molybdenum does not give immunity to intergranular attack of austenitic stainless steels.

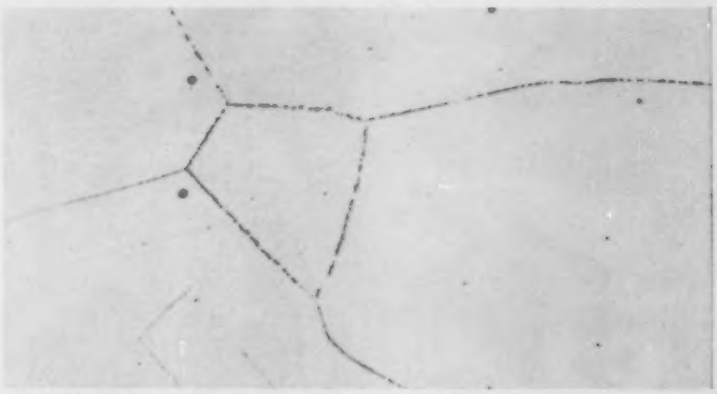
Type 316 tubing with extra-low carbon or 316 Cb was recommended in this case. This tubing would permit stress relieving without the danger of developing sensitivity to intergranular corrosion. In this type of attack corrosion generally occurs because of the loss of stainlessness at the grain boundary areas.

Sensitized metal . . . Chromium-rich carbides precipitate intergranualarly at 800°-1,000° F. (see Fig. 4). Therefore the level of chromium at these locations is reduced to less than necessary to maintain protective surface layer. The metal is sensitized. These grain boundary areas corrode rapidly—preferably as lower chromium steel.

Sometimes the metal may appear relatively unattacked having suffered only small total weight loss of grain boundary material. But it has lost its integrity and usefulness. It gives off a dead sound when struck. Harmful carbide precipitation during welding or other short-time exposure at these intermediate temperatures may be minimized by using 0.03 per cent maximum carbon steel.

Additions of columbium or titanium stabilize austenitic stainless steels indefinitely against intergranular chromium carbide precipitation. This is done by combining with the carbon instead of chromium. Many corrodants cause general attack and wastage at elevated temperatures. Most common of these is oxygen.

The author is metallurgist, Tubular Products Division, Babcock & Wilcox Co. Article presented at Western Petroleum Refiners Association meeting, Wichita.



INTERGRANULAR carbide precipitation in sensitized Type 317 tube. Fig. 4.

Oxygen leads to the formation of the familiar oxide scale on heater tubing and other equipment.

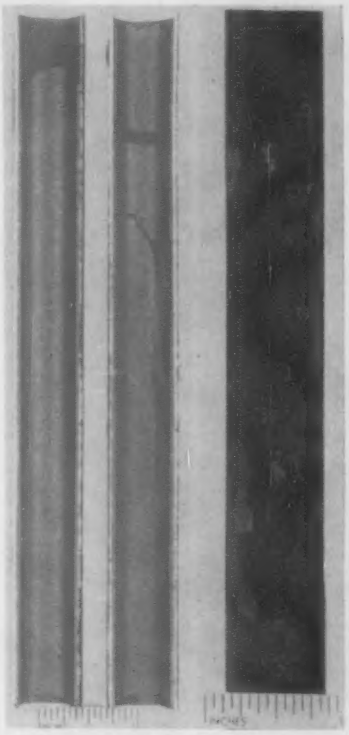
High-temperature attack doesn't have the same electro-chemical nature as most corrosion at lower temperatures.

High-temperature attack is chemical attack. It exerts a deteriorating influence on the metal.

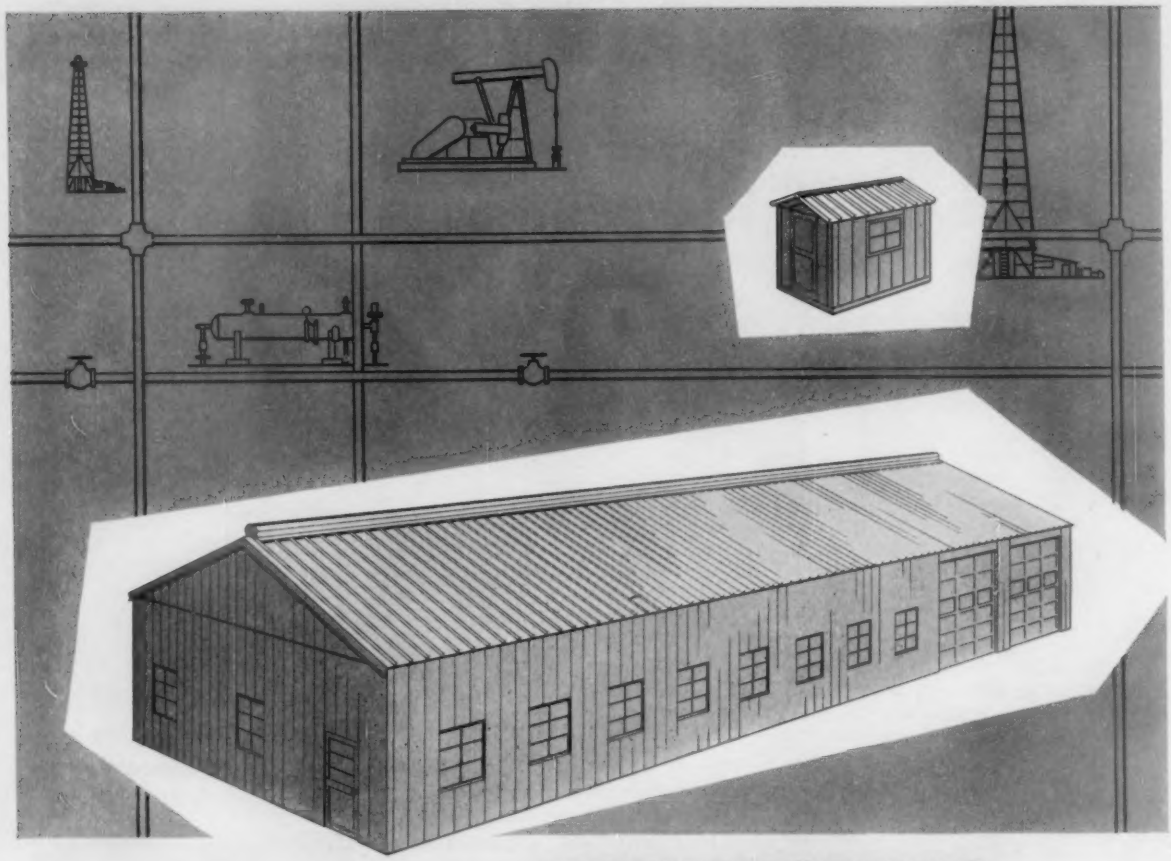
Oxide-scale formation is a familiar problem. The use of chromium-bearing steels is the normal remedy and it is used also for many cases of high-temperature sulfur corrosion by sour oils.

Refinery equipment . . . In connection with sulfur attack of refinery equipment, general sulfide type of corrosion currently being found in modern catalytic reformers has brought forth new concepts. Some reconsideration of this has been given this kind of attack and methods of combating it have been developed.

Sulfide corrosion in reforming is evidenced by the formation of iron sulfide scale. Fig. 5 shows Croloy 2¼-in. tubing from a platformer heat-exchanger handling product at about 920° F. It exchanges this heat against the reactor input charge. The tube size originally was ¾ by 0.083 in. but corrosion with the formation of iron sulfide at both o.d. and i.d. reduced the wall to 0.044 in.



SULFIDE corrosion product at o.d. and i.d. of Croloy 2¼-in. Platformer tubing. Fig. 5.



a vital part of the picture . . .

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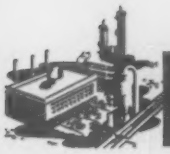


JOB IMPROVEMENT FOR THE PROCESS FOREMAN—79

Heat-Transfer-Equipment Classifications

AN example of how to determine B.t.u.'s is shown here:

Cool:

100,000 lb. per hour of gasoline
Inlet temperature 180° F.
Outlet temperature 120° F.

Heat removed = weight × temperature change × specific heat.

Heat removed = 100,000 × (180−120) × 0.54.

Heat removed = 100,000 × 60 × 0.54 = 3,240,000 B.t.u. per hour.

Since the over-all transfer coefficient, temperatures, and surface area effect the transfer of heat, they must be arranged in such a way that a mathematical solution is possible. This is done in the expression:

$$Q = UAT_m$$

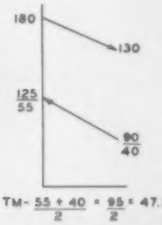
Q = heat transferred in B.t.u./hr.
U = over-all coefficient, B.t.u./hr./ft.²/°F.
A = transfer surface, ft.²
T_m = mean temperature difference, °F.

To demonstrate the use of this equation, the gasoline cooler in the problem above is selected as an example.

Problem . . . How many square feet of heat-exchange surface is required to cool 100,000 lb. per hour of gasoline from 180° to 130° F. with cooling water entering at 90° F. and leaving at 125° F.?

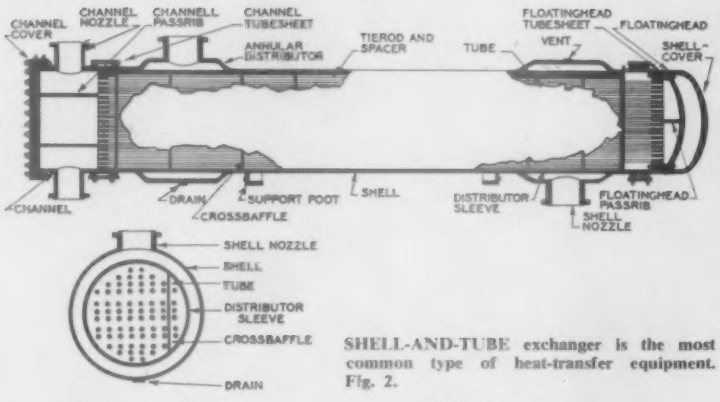
Solution:

1. Determine mean temperature difference, T_m.

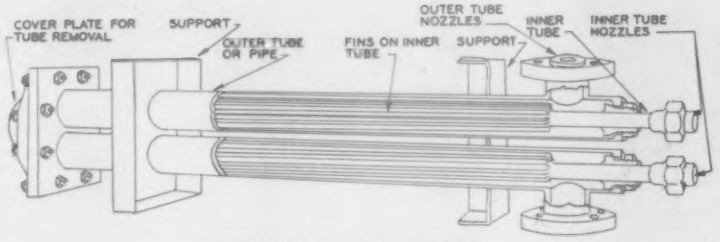


$$TM = \frac{55 + 40}{2} = \frac{95}{2} = 47.5°F.$$

This material is taken from "Fundamentals of Refining," operating manual of Magnolia Petroleum Co., refining division, Beaumont, Tex.



SHELL-AND-TUBE exchanger is the most common type of heat-transfer equipment. Fig. 2.



DOUBLE-PIPE exchanger. Fig. 3.

2. Determine heat load, Q. See Example 1:

$$Q = 3{,}240{,}000 \text{ B.t.u./hr.}$$

3. Determine over-all coefficient, U. See chart of typical values:

$$U = 110$$

4. Calculate area required.

$$Q = UAT_m$$

$$A = \frac{Q}{UT_m} = \frac{3{,}240{,}000}{110 \times 47.5}$$

= 620 sq. ft. required.

This amount of surface would be contained in an exchanger 20 in. in diameter, with 224 ¾-in. o.d. tubes, 16 ft. long and would cost approximately $5,500.

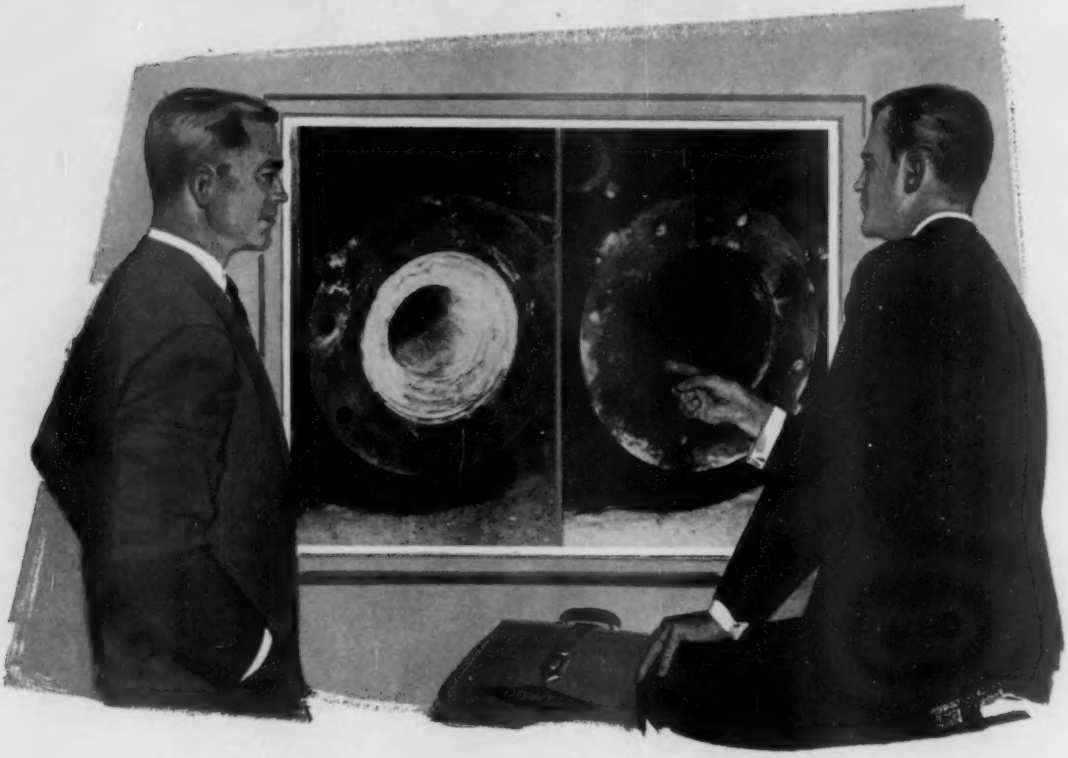
Exchangers, coolers, and condensers are used to exchange heat between hot and cold process streams, cool product streams for storage, and to condense overhead vapor streams to liquid for use as blending stocks or salable products.

By properly utilizing such equipment, it is possible to effect fuel savings, reduce power consumption by more efficient use of cooling water, and reduce the loss through evaporation of salable products.

Heat-transfer equipment may be classed in three general categories: exchangers, coolers, and condensers. Exchangers transfer heat from a hot process stream to a cold process stream. Coolers transfer heat from a hot medium to cooling water. Condensers remove heat from vapors, condense these vapors and heat the cooling water.

The most common type is the shell-and-tube exchanger shown in Fig. 2. Supplementing this type is the double pipe exchanger shown in Fig. 3. In this type, one fluid flows in the small, inner pipe and the other fluid in the space between the small, inner pipe and the larger, outer pipe.

here's how Dowell chemical cleaning saved $71,000 and helped protect a plant profit!



A few months before their peak season, the operators of this plant decided their main water line might not supply the water necessary to meet peak demands. The line was cast-iron, 16-inches in diameter and over 7,000 feet long. Its original flow efficiency or "C" factor had been 105; scale build-up had reduced this to 72. To lay an auxiliary line would cost at least $85,000.

Dowell contracted to clean the pipe chemically for a little less than $14,000, and to restore a minimum of 50 per cent of the line's lost capacity.

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A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

by D. W. Patterson
The Datics Corp.

Using Electronic Computers in the Oil Industry

Part 4

What Scientific Data Reduction Includes

DATA reduction, as used throughout this series of articles, refers to those operations performed on raw data which in general produce a more meaningful, useful form for the data consumer. Operations such as editing, applying scale factors, nonlinear corrections, and transcription are considered parts of this process.*

In practice these manipulations ordinarily begin following the instrumentation of data-acquisition stages and frequently precede and follow the detailed computation stage, as outlined in Fig. 1.

This article will consider various types of data reduction while future articles will treat details of equipment types and the techniques employed.

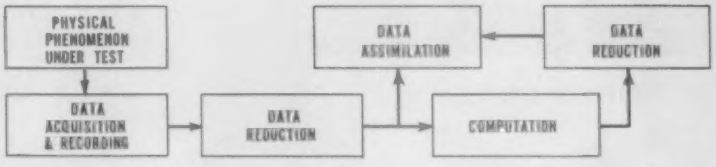

Fig. 1.

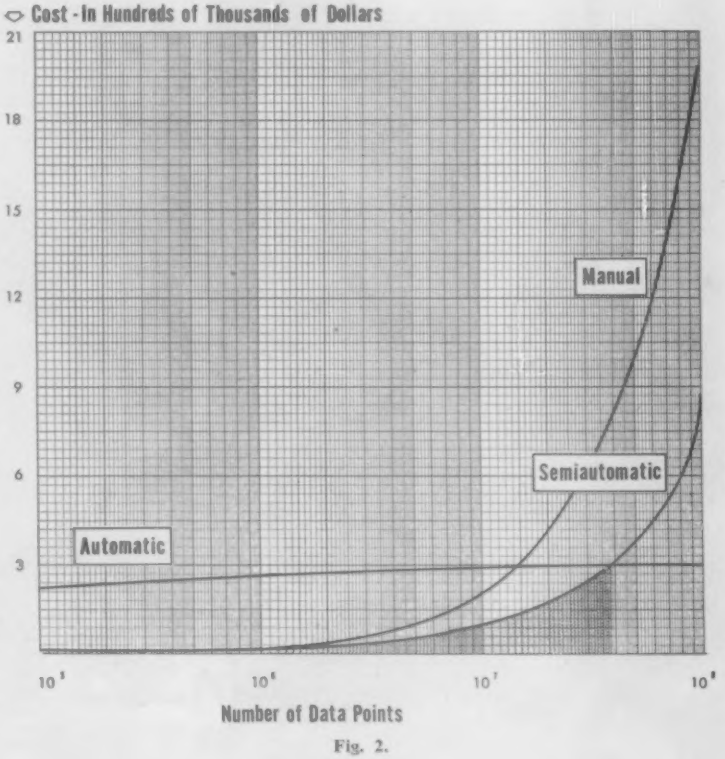

Fig. 2.

Types of data reduction . . . Raw test data requiring reduction is usually stored on one of several media: Photographic film, paper records, magnetic tape, and numerous electronic devices. The most commonly used media are paper charts, film, and magnetic tape.

Three basic methods of reducing data from these storage media are generally recognized. In the first method, the manual method, the reduction is accomplished by individuals armed with dividers, scales, and pencils. With semiautomatic methods, individuals read the records with the aid of semiautomatic measuring devices which are coupled directly with automatic recording devices.

Automatic data reduction is possible and equipment is available for reading and manipulating the information completely by machines. The direct reduction of film or oscillographic types of records is almost completely accomplished by the first two methods.

The required operations and the sequence in which they are performed are as follows:

Editing . . . Frequently, all of the information available on the record is not desired. Some of the information is redundant and some of it is simply noise. For example, in the determination of the response of an aircraft's control surfaces only the data obtained during certain maneuvers may be required. In the reduction of seismograms only those portions picked as true reflections are required. The remaining portion of the traces can be disregarded.

Scaling . . . Scaling is the operation of orienting the recorded information to an appropriate graphical or digital reference value. The most-common method of scaling involves an initial transcription or conversion from analog to digital form.

Once converted, the digits can be operated on point by point, making the necessary calculations numerically. In some instances scaling is accomplished directly during recording. This latter technique is most common in the oil and gas industries where the recording instruments are precalibrated.

(Continued on next page)

*It should be noted that while medium to large-scale computation is actually a part of the over-all reduction process, it is considered a separate phase of processing for the purposes set out here.

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Calibrations . . . Nonlinear calibrations are necessary when the acquisition and recording instruments introduce nonlinearities in excess of the accuracy tolerances. Very often the nonlinear correction operations can be combined with scaling and thereby reduce the total number of operational steps.

Transcription . . . If the information is in the desired units following the scaling and calibrating steps, it may be desirable either to leave it in digital form or to transcribe the values to a plot. If the units must be altered, computation may be required. In this case, it may be necessary to transcribe the numerical values into punched paper tape or punched cards. Following computation the information is usually returned in the form of tape or cards and hence must again be transcribed to either typewritten values or plots.

In the automatic reduction of data, the original information is most commonly reduced during a playback of a magnetic recording. In some instances, these data must be reduced in real time. That is, the reduced information must be obtained in time to be used in the control or regulation of the process itself. Some automatic items of equipment have been designed to perform all of the above operations with the exception of editing.

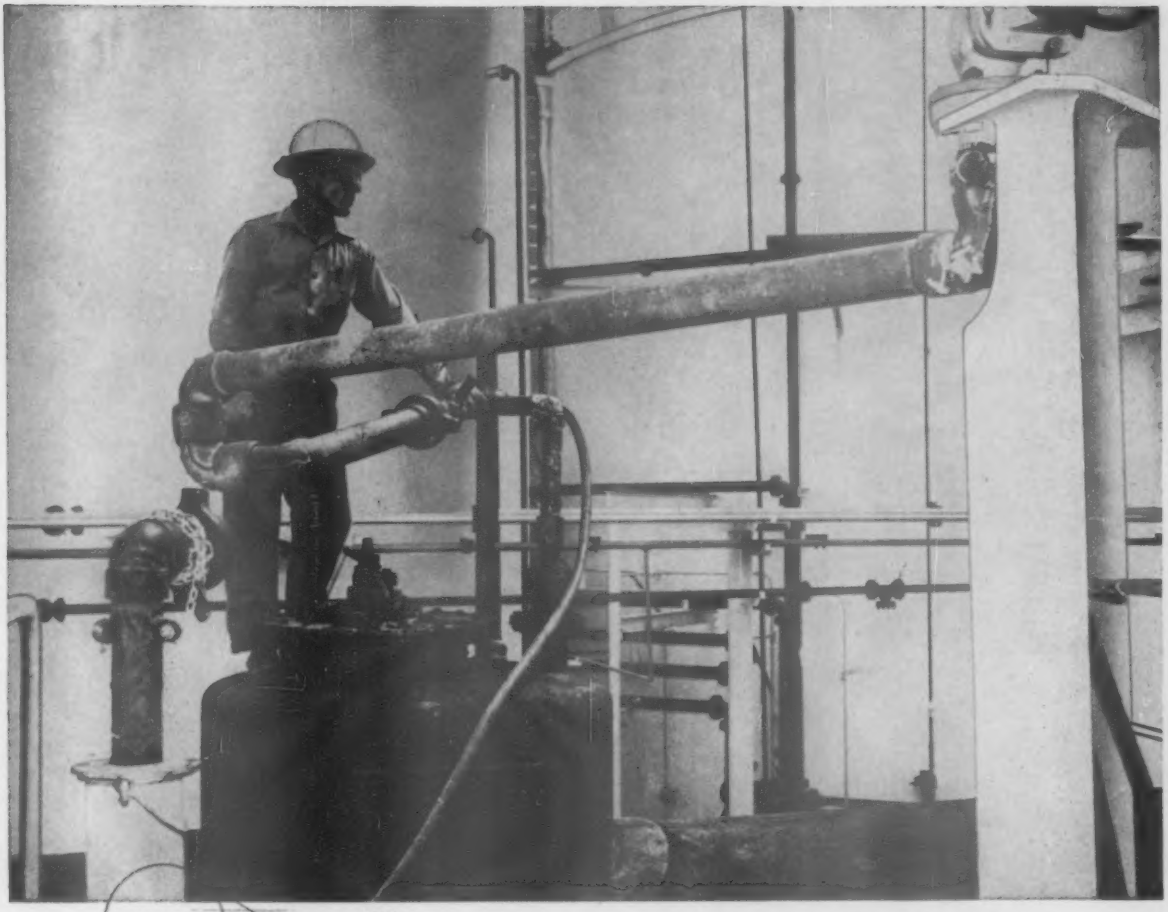
Each of the three methods of data reduction — manual, semiautomatic, and automatic—has its merits, of course. The best method to be used in an individual case must be determined by evaluating the following factors:

1. Quantity of data.
2. Nature of the data.
3. Accuracy requirements.
4. Time requirements.

These factors will determine which method is the most economical approach.

While each individual case must be evaluated differently, a general cost yardstick, such as Fig. 2, can be prepared. These figures were prepared using the cost of reducing oscillographic data. A comparison such as this reveals the approximate crossover points where cost of each of the methods are equivalent. For example, the area shaded under the semiautomatic curve indicates the range of data points reduced most economically using semiautomatic techniques.

A future Petrodatics article will explore various principles employed in each type of data reduction.



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YOU CAN DEPEND ON DOW

Pipeline Patrol

. . . Report on Construction

Under Way, Contracted, and Planned

PIPELINE activity reported here is compiled from surveys conducted by The Oil and Gas Journal among pipeline companies and contracting firms. Projects listed include those proposed, contracted, and under way. Uncontracted projects are indicated by • preceding the project.

Crude-Oil Pipelines

• **Cape Pipe Line Co.** (organized by Sun Oil Co., Cities Service Co., Atlantic Refining Co.)

Project: Long range plans for line on the lower Delaware Bay to the Philadelphia refining area.

Completion: 1960.

Fulton, R. H. & Co., Lubbock, Tex.

Project: 39 miles of 6-in. from Donkey Creek field in northeastern Wyoming, southeast to the Osage pump station in Weston County.

Status: Fulton, a contractor has applied to Wyoming Public Service Commission.

• **Interstate Oil Pipe Line Co.**

Project: 5 miles of 4-in. from South Bosco field, Louisiana, to present main line, and 5 miles of various size from Church Point field, Louisiana, to present main line.

Status: Proposed.

• **Northwest Pipeline Corp.** (an affiliate of Pacific Northwest)

Project 80 miles of 8-in. and 300 miles of 10-in. crude and products line from Four Corners area to Salt Lake City.

Status: To start May 1957.

Completion: August 1957.

• **Offshore Gathering Corp.,** Houston.

Project: 364 miles of mostly 20-in. in Gulf of Mexico off Louisiana. (Dual line.)

Status: Proposed.

• **Pasotex Pipe Line Co.**

Project: 127 miles of 20-in. along its route from Wink to El Paso. retiring another dual 8-in. section.

Status: Under way.

Completion: July 1, 1957.

• **Four-Corners Pipe Line Co.** (newly formed by Shell Oil Co., Standard Oil Co. of California, Continental Pipe Line Co., Gulf Oil Corp., Richfield Oil Corp., Superior Oil Co.)

Project: 600 miles of line from near Farmington, N. Mex., in the Four Corners area to Los Angeles, to be constructed and operated by Shell Pipe Line Corp. as agent for the companies.

Status: Construction to start in April. Preliminary engineering work under way.

• **Sinclair Pipeline Co.**

Project: 150 miles of 20-in. from Teague, Tex., to Houston.

Status: Planned for 1958.

Completion: 1958.

• **Tecumseh Pipe Line System** (Joint venture of Sinclair Pipe Line, Ashland Oil & Refining, and Pure Oil Co.)

Project: 190 miles of 20-in. between Griffith, Ind., and Cygnet, Ohio.

Status: Under way.

Completion: September 1957.

• **Texas-New Mexico Pipe Line Co.** (owned by The Texas Co., Sinclair Pipe Line Co., Tidewater Oil Co., and Empire Gas & Fuel Co.)

Project: 515 miles of 16-in. from southeast corner of Utah to Jal in southeastern New Mexico.

Status: Field surveys began January 1957.

Union Oil Co. of California.

Project: 45 miles of 12-in. and 180 miles of 16-in. crude and products line from San Joaquin Valley to its Oleum refinery at Rodeo, Calif.

Status: Under way.

Contractor: **Roy Price, Inc.**

Completion: April 1, 1957.

Products Pipelines

• **American Pipe Line Co.**

Project: Line from Gulf Coast to New York City area. Received ODM approval to amortize 40 per cent of $175,000,000 cost with a rapid writeoff.

Status: Proposed.

Buckeye Pipe Line Co.

Project: Conversion of 116 miles of 8-in. crude to products between Huntington, Ind., and Griffith, Ind.

Status: Planned.

Contractor: **Sheehan Pipe Line Construction Co.**

Completion: Fall 1957.

Project: Conversion of 32 miles of 8-in. crude to products between Mantua, Ohio, and Youngstown area.

Status: Planned.

Contractor: Company will do own work.

Completion: November 1957.

• **El Paso Natural Gas Co.**

Project: 11 miles of 4-in. L.P.G. products from Snyder Line to South Andrews Plant, Texas.

Status: Planned.

• **Great Lakes Pipe Line Co.**

Project: 84 miles of 8-in. from south of St. Paul to Eau Claire, Wis.; 68 miles of 12-in. from Great Lakes intersecting point with Badger Pipe Line to Chicago.

Status: Construction scheduled to start spring 1957.

• **Gulf Refining Co.**

Project: 530 miles of 10-in. L.P.G. and natural gasoline line from Waddell Plant in Crane County, Texas, to Mont Belview near Houston (368 miles is conversion from crude service).

Status: Under way.

Contractor: **Panama-Williams Corp.** has 46 miles from Waddell Plant to Midland. Remainder not let.

• **Interstate Oil Pipe Line Co.**

Project: Four 38-mile lines from the Esso Standard Oil Co. refinery at Baton Rouge to Sorrento, La.: two 4-in. lines; one 6-in. line; one 8-in. line. Lines will carry ethylene, butane, and propane.

Status: Under way.

Contractor: **Fowler-Tatom Pipeline Contractor.**

Completion: April 1, 1957.

• **Laurel Pipeline Co.** (Gulf Refining Co. and Sinclair Pipe Line Co.)

Project: A 24-in. line from the Philadelphia refining area to Cleveland.

Status: Under construction.

• **Northwest Pipeline Corp.** (an affiliate of Pacific Northwest)

Project: 80 miles of 8-in. and 300 miles of

O. R. BURDEN Construction CORP.

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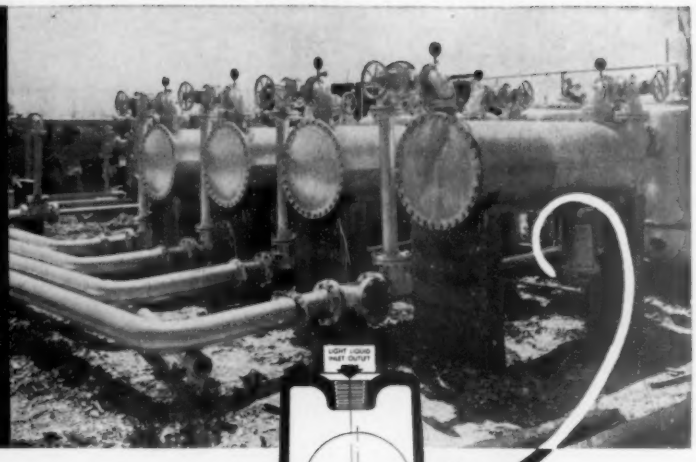

ARMSTRONG Dual Gravity Traps automatically drain water from light liquids. They eliminate manual draining and guesswork and prevent water from contaminating the light liquid.

Armstrong Dual Gravity Traps are available in cast iron or forged steel for a wide range of pressures and capacities. Mechanisms are stainless steel or bronze.

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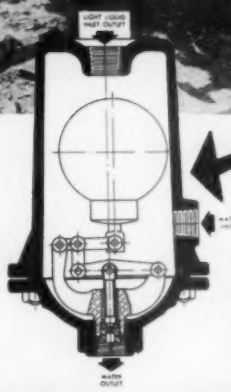
Dual Gravity Trap Bulletin No. 2091 gives full details — sizes, pressures, capacities, selection instructions, gravity conversion data. Send for free copy today.



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Pipeline Patrol

10-in. products and crude line from Four Corners area to Salt Lake City.
Status: To start May 1957.
Completion: August 1957.

- **Ohio Oil Co.**
Project: 350-miles of 12-in. from Wood River, Ill., to Chicago.
Status: Planned. Starting date depends on pipe delivery, which may not be completed until 1958.
- **Southern Pacific Pipe Lines, Inc.**
Project: 100 miles of 10-in., 80 miles of 8-in., and 125 miles of 6-in. between Richmond, Calif., and Fallon, Nev.
Status: Under way.
Contractor: **River Construction Corp.** has 84 miles of 8, 10-in. from Richmond to Stockton, Calif. to complete late spring 1957, F. O. Traweek, spread superintendent, office at Richmond. **Hood Constructtion Co.,** Lynwood, Calif., has 58 miles of 10-in. from Stockton to Roseville, Calif. **Engineers, Limited Pipeline Co.** and **Joe E. Young Pipe Line Construction Co.** have 18 miles of 6 and 8-in. between Roseville and Donner Summit.
Completion: August 1, 1957.
- **Union Oil Co. of California**
Project: 815-mile line from Rifle, Colo., to Los Angeles refining area, to carry products from its proposed Rifle shale-oil plant.
Status: Proposed.
- **Yellowstone Pipe Line Co.**
Project: 22 miles of 8-in. near Spokane, Wash.
Status: Planned.
Completion: March 1, 1957.

Natural-Gas Pipelines

- **Arkansas Louisiana Gas Co.**
Project: Line from Texas-Louisiana coastal region to northern Louisiana, to connect with their present system.
Status: Long-range plans.
- **Carolina Pipeline Co.**
Project: Distribution lines to serve 14 cities in Central South Carolina. Will buy gas from Transcontinental Gas Pipeline Co. or Southern Natural Gas Co.
Status: Has received South Carolina Public Service Commission permit.
- **Cities Service Pipe Line Co.**
Project: 27 miles of 6-in. from Lake Charles, La., to Orange, Tex.
Status: Planned.
Completion: April 30, 1957.
Project. 64 miles of 6 to 30-in. in Leavenworth and Anderson counties, Kansas, Cass County, Missouri. and Oklahoma County, Oklahoma.
Status: Planned.
- **Coastal Transmission Corp.**
Project: 575 miles of 12, 20, 22, 24-in. main line and 414 miles of 2 to 14-in. gathering lines between McAllen, Tex., and Baton Rouge, La.
Status: Has conditional FPC approval.
Completion: January 1, 1958.
- **Colonial Natural Gas Corp.**
Project: Two systems; one between Houston-Lake Charles area and Miami, Fla.; one in the Carolinas and Georgia.
Status: Proposed.
- **Colorado Interstate Gas Co.**
Project: 1957 program . . . 66 miles of 30-in., 40 miles of 34-in., 109 miles of 26-in., and 100 miles of 24-in. from Springfield, Colo., to Pueblo, Colo; 345 miles of 30-in. from Kit Carson, Colo., to Beatrice, Neb.; 50 miles of 22-in. from Laverne to Hooker, Okla.; 24 miles of 22-in. Panhandle field looping.
Status: Pending FPC approval.
- **El Paso Natural Gas Co.**
Project: 338 miles of 34-in. from San Juan

CROSE . . . LINE TRAVELING
COATING & WRAPPING MACHINES
THE FINEST ON THE LINE BECAUSE OF IT'S SPRAY-RING APPLICATOR

Uniform Coating Precision Wrapping
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More contractors use CROSE machines because they have all the features required for most trouble-free, highest quality performance. Available in sizes that handle pipe 2" to 36".

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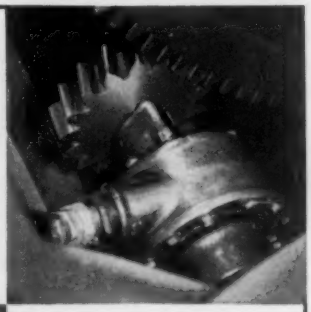
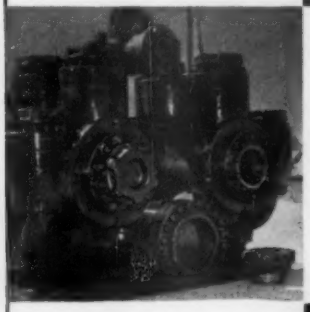
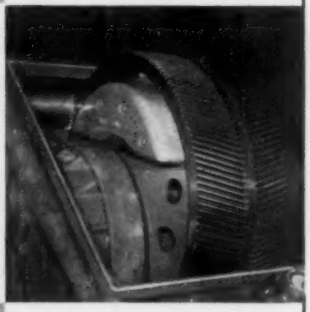
Dual, gear-driven oil pumps. Assure full lubrication at all times. Driven directly from the helical gears.



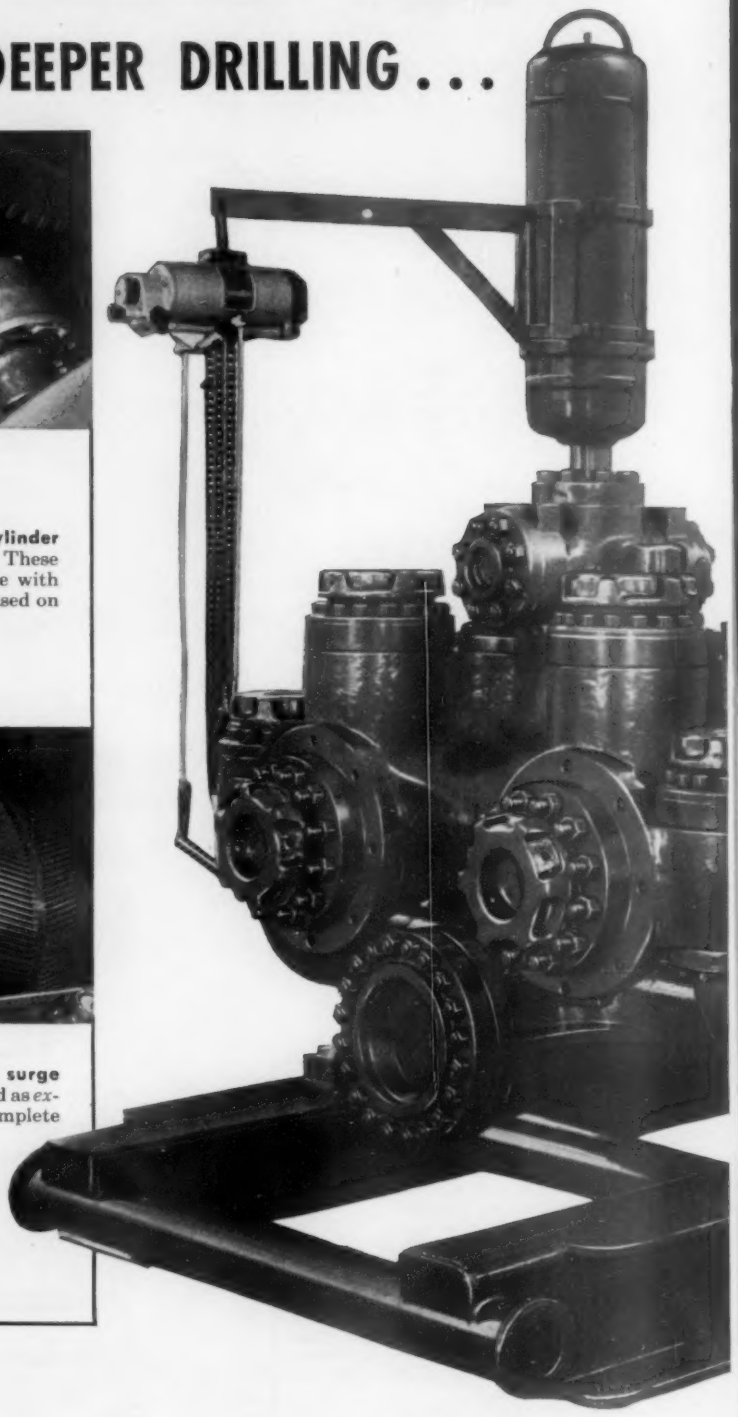


Threaded fluid cylinder locks and rings. These are interchangeable with valve cover locks used on valve pots.

Counterbalanced eccentric. This exclusive GH-GXH feature helps reduce unbalanced forces usually transmitted to the pump foundation or mounting platform.



Newly designed surge chamber. Furnished as *extra equipment*, complete with boom, Keller half-ton hoist, trolley, filter and lubricator, and 8′ air hose. Simplifies handling of heads, valve locks, liners, etc.



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Gardner-Denver 1250 h.p. mud pump GH-GXH. Liner sizes, 7¾″ to 6″. Stroke, 18″. Deliver from 884 gpm at 2060 psi, using 7¾″ liners, to 500 gpm at 3642 psi, with 6″ liners.

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Pipeline Patrol

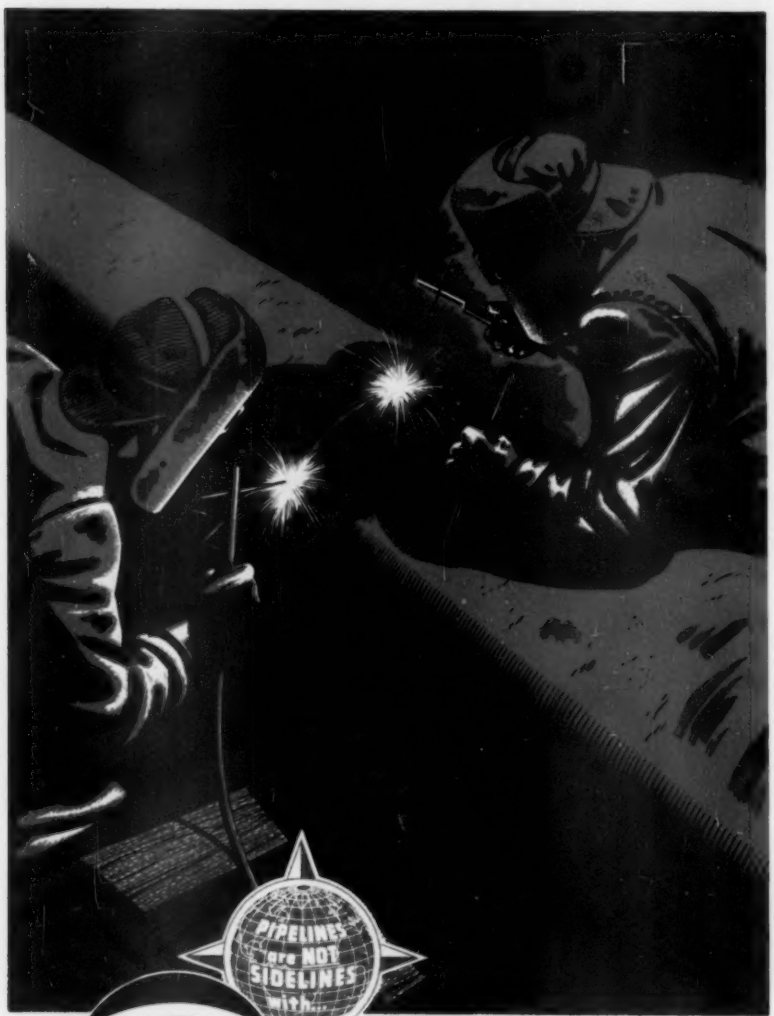
and Permian basins to California border.
Status: Under way.
Contractor: **R. H. Fulton Co.** has 102 miles; **Western Pipeline, Inc.,** has 144 miles; El Paso will construct remaining 92 miles.
Completion: April 1957.
Project: 83 miles of 34-in. from San Juan and Permian basins to California border, plus about 800 miles of gathering lines.
Status: Planned.

Fish-Service & Management Corp. (Agent for Cascade Gas Co.)
Project: City distribution system—205 miles of 1 to 8-in. in Washington and Oregon.
Status: Under way.
Contractor: **Ted Price Construction Co.,** Electric, Tex. Three spreads—M. E. Pulliam, spread superintendent, office at Walla Walla, Wash.; K. D. Garrett, spread superintendent, office at Pendleton, Ore.; E. E. Hanks, spread superintendent, office at Baker, Ore.
Completion: March 1957.

• **Houston Texas Gas & Oil Corp.**
Project: 943 miles of 26-in. between Baton Rouge, La., and Miami, Fla., plus 682 miles of sales laterals in Florida, with main line joining Coastal Transmission's proposed line from McAllen, Tex., to Baton Rouge.
Status. Has conditional FPC approval.

• **Iron Ranges Natural Gas Co.,** St. Paul.
Project: 68-mile transmission line and 47 miles of laterals to supply towns on the Mesabi Iron Range, Minn.
Status: Application pending with FPC.

• **Kansas-Nebraska Natural Gas Co.**
Project: 61 miles of various size gathering line in Camerick field, Texas County, Oklahoma.
Status: Approved.



Now under construction: West Coast Transmission Line

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OIL • GAS • WATER • PRODUCTS PIPELINES • PUMPING STATIONS

Project: 10 miles of 10-in. between Grand Island and Fullerton, Nebr.
Status: Approved.
Completion: May 1, 1957.
Project: 12 miles of 12-in. between Scott City and Colby, Kans.
Status: Approved.
Completion: May 1, 1957.

Michigan Consolidated Gas Co.
Project: 67 miles of 10 and 12-in. between Sears and Travers City, Mich.
Status: Under way.
Contractor: **Somerville Construction Co.;** Floyd Huduall, spread superintendent, office at Cadillac, Mich.
Project: 60 miles of 10 and 12-in. between Muskegon and Ludington, Mich.
Status: Under way.
Contractor: **Somerville Construction Co.,** jointly with **J. L. Gentry Construction;** Frank Morris, spread superintendent, office at Hart, Mich.

• **Michigan Wisconsin Pipe Line Co.**
Project: 24 miles of 24-in. and 16 miles of 4-in. looping in Michigan, Indiana, Illinois, Wisconsin, Iowa, and Missouri.
Status: Approved.
Completion: 1957.

• **Midwestern Gas Transmission Co.**
Project: Will build main line from Portland, Tenn., to Canadian border near Emerson, Man.; 829 miles of 24-in., 109 miles of 16-in., 174 miles of 12-in., 648 miles of 3 to 18-in. extensions in Minnesota and Wisconsin.
Status: Application pending with FPC.

• **Mountain Fuel Supply Co.,** Salt Lake City.
Project: 38 miles of line to connect with Pacific Northwest Pipeline Corp.'s system in Sweetwater County, Wyoming.
Status: Has temporary FPC permit.

• **Natural Gas Pipeline Co. of America**
Project: 350 miles of 20 and 26-in. from Jack and Wise counties, Texas, to Fritch, Tex.
Status: Has FPC approval.
Project: 389 miles of 36-in. loops along its line from Beatrice, Neb., to Chicago, to take gas from proposed line of Colorado Interstate Gas Co., and for 91 miles of 30-in. loops along parts of its main line.
Status: Application pending with FPC.

• **North Carolina Natural Gas Corp.** (Subsidary of Colonial Natural Gas Corp.)
Project: 575 miles of 3 to 16-in. from Transcontinental Gas Pipe Line Corp.'s system near Mooresville, eastwardly across north Carolina.
Status: Has permit from North Carolina Utilities Commission.

• **Northern Natural Gas Co.**
Project: 160 miles of 2, 3, 6, 8-in. branch lines to serve 20 new communities on Aberdeen, S. D., line.
Status: Under way.
Contractor: **Troth Construction Co.**
Project: 73 miles of 20-in. from Savana Creek to Pincher Creek fields in Alberta, Canada; 32 miles of 24-in. from Pincher Creek to Montana border; 1,100 miles of 26-in. from Montana into Minneapolis.
Status: Planned.

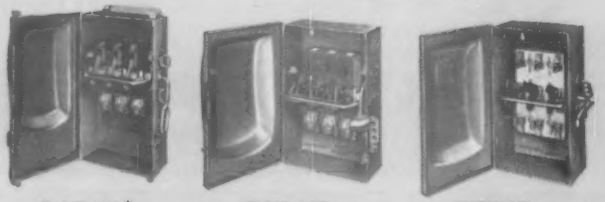
• **Offshore Gathering Corp.,** Houston.
Project: 364 miles in Gulf of Mexico off Louisiana.; 60 miles of 24-in., 70 miles of 26-in., 234 miles of 30-in. (Dual line.)
Status: Application pending with FPC.

• **Ohio Fuel Gas Co.**
Project: 7 miles of 12-in. near Fremont, Ohio.
Status: Planned.
Completion: First half 1957.
Project: 23 miles of 18, 20-in. from Gibsonburg to Toledo.
Status: Uncertain.
Project: 152 miles of line in Ohio: 38 miles of 24-in. from Crawford Station to Utica; 18 miles of 24-in. from Pavonia Station to Line D; 6 miles of 20-in. from Mount

FIRST with a COMPLETE LINE OF SAFETY SWITCHES to meet the NEW NEMA STANDARDS

• The table below shows Square D switches meeting new industry specifications. Notice how they clarify conflicting features which existed under old designations. Notice, too, that they establish a new, heavy-duty industrial switch, Type HD.

One important thing which remains unchanged is the **DESIGN LEADERSHIP** which has made **SQUARE D SAFETY SWITCHES** an overwhelming **FIRST** choice in the petroleum and chemical industries for more than fifty years.



TYPE HD* **TYPE ND** **TYPE LD**

Available in NEMA 12, NEMA 4, 5, 7 and 9 Enclosures

DESCRIPTION	HEAVY DUTY New	NORMAL DUTY formerly Types H, S, or A	LIGHT DUTY formerly Types D or G
Rating-Ampere Voltage	30—600 250 or 600V AC, DC	30—1200 250 or 600V AC, DC	30—200 250V AC
Enclosure	NEMA 12 • Industrial Use (Gasketed) NEMA 4 & 5 • Water-tight & Dust-tight NEMA 7 • Explosion-resisting Class I—Group D NEMA 9 • Explosion-resisting	NEMA 1 • General Purpose NEMA 3R • Raintight	NEMA 1 • General Purpose NEMA 3R • Raintight
Horsepower Rating	NEC Fuse Ratings Dual-Element Fuse Ratings	NEC Fuse Rating Dual-Element Fuse Ratings	NEC Fuse Rating
Operating Mechanism	Quick-Make, Quick-Break Independent of Handle	Quick-Make, Quick-Break Independent of Handle	Positive Make, Positive Break Spring Assisted
Cover	Interlocked & Padlock Attachment	Interlocked & Padlock Attachment	Padlock Attachment
Plating—Current Parts	Extra-Heavy Silver	Silver	
Endurance	Maximum Endurance Far Exceeds UL Standards	Exceeds UL Standards	Meets UL Standards

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

SQUARE D COMPANY

for

easy to make

connections

join pipe

THE DRESSER WAY!

Anywhere you're joining pipe, the handiest, surest way to get safe, bottle-tight joints is with Dresser Couplings or Long Sleeves.

Dresser Couplings provide the "give and take" necessary to absorb vibration, settlement and other stresses. Specially compounded rubber gaskets permit up to 4° deflection at joints — yet with Dresser Couplings, these joints stay permanently tight.

The only tool you need is a wrench — pipe threading is not necessary. Any workman can install Dresser Couplings, averaging only two man-minutes per bolt.

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Dresser Manufacturing Division • Bradford, Pa.

ONE OF THE DRESSER INDUSTRIES

A 16" Dresser Coupling on a water jacket in a field processing plant

AVAILABLE AT ALL LEADING OILFIELD SUPPLY STORES IN THE UNITED STATES AND CANADA

Style 38 Coupling

Style 40 Long Sleeve

Hydrepair® Asbestos Cement Pipe Clamp

Style 63 Expansion Joint

Style 39 Insulating Coupling

Pipeline Patrol

Gilead to Claridon: 4 miles of 20-in. near Dayton; 4 miles of 20-in. near South Charleston; 7 miles of 16-in. near Springfield; 6 miles of 20-in. nnear Oberlin; 17 miles of 20-in. from Oak Hill to Symmes Station; 7 miles of 12-in. from Mount Sterling to Bloomingburg; 2 miles of 8-in. near Bellefontaine; 3 miles of 12-in. near Mansfield; 4 miles of 12-in. near Lakeville; 7 miles of 8-in. in Guernsey and Belmont counties.

Status: Planned.

Completion: Second half 1957.

• **Pacific Gas & Electric Co.**

Project: 37 miles of 20-in., 37 miles of 18-in., 9 miles of 12-in. from Beehive Bend field near Willows, Calif., to near Davis, then to Sacramento.

Status: Under way.

Contractor: **Engineers Limited Pipeline Co.**

Project: 135 miles of 34-in. looping of the Topock-Milpitas line.

Status: Under way.

Contractor: A joint-venture firm, **Midwestern-Johnson-Dixon,** has 85 miles to complete this year.

Completion: Major part was laid in 1956; 52 miles to be completed in 1957.

Project: 200 miles of 12-in. from Sacramento Valley gas fields to Humboldt County, California.

Status: Has filed for approval of California's Public Utilities Commission. To start early 1957.

Completion: December 1, 1957.

• **Pacific Northwest Pipeline Corp.**

Project: 37 miles of 6-in. from Dove Creek to Nucla, Colo., and 13 miles of 4-in. from Nucla to Urvan, to serve Union Carbide Nuclear Co. and Vanadium Corp. of America.

Status: Has FPC permit.

Project: 1,000 miles of gathering lines and laterals along present line.

Status: Planned.

Completion: 1957.

• **Peoples Natural Gas Co.**

Project: 8 miles of 8-in. between Claysburg and Hollidaysburg, Pa.

Status: Planned.

Completion: August 1957.

• **Permian Basin Pipeline Co.**

Project: 83 miles of 16-in. from its Spraberry station in Midland County, Texas, to tie in with Pioneer Gathering System, Inc., at a point in northwestern Schleicher County, Texas.

Status: Filed for FPC approval.

• **Piedmont Gas Co.,** Hickory, N. C. (Parent is Carolina Natural Gas Corp.)

Project: 78 miles of 2 to 8-in. extension off Trancontinental in North Carolina to serve Gaston, Lincoln, Catawba, Caldwell, and Burke counties.

Status: Application pending with FPC.

• **Pioneer Gathering System, Inc.**

Project: 27 miles of 16-in. and 27 miles of 12-in. in Schleicher and Sutton counties, Texas.

Status: Filed for FPC approval. Estimate to start work March 1, 1957.

Completion: July or August 1957.

Southern California Gas Co. and Southern Counties Gas Co. of California.

Project: 241 miles of 30-in. from the outskirts of Los Angeles to Topock on the Arizona-California border.

Status: Under way.

Contractor: **R. H. Fulton & Co.**

Completion: June 30, 1957.

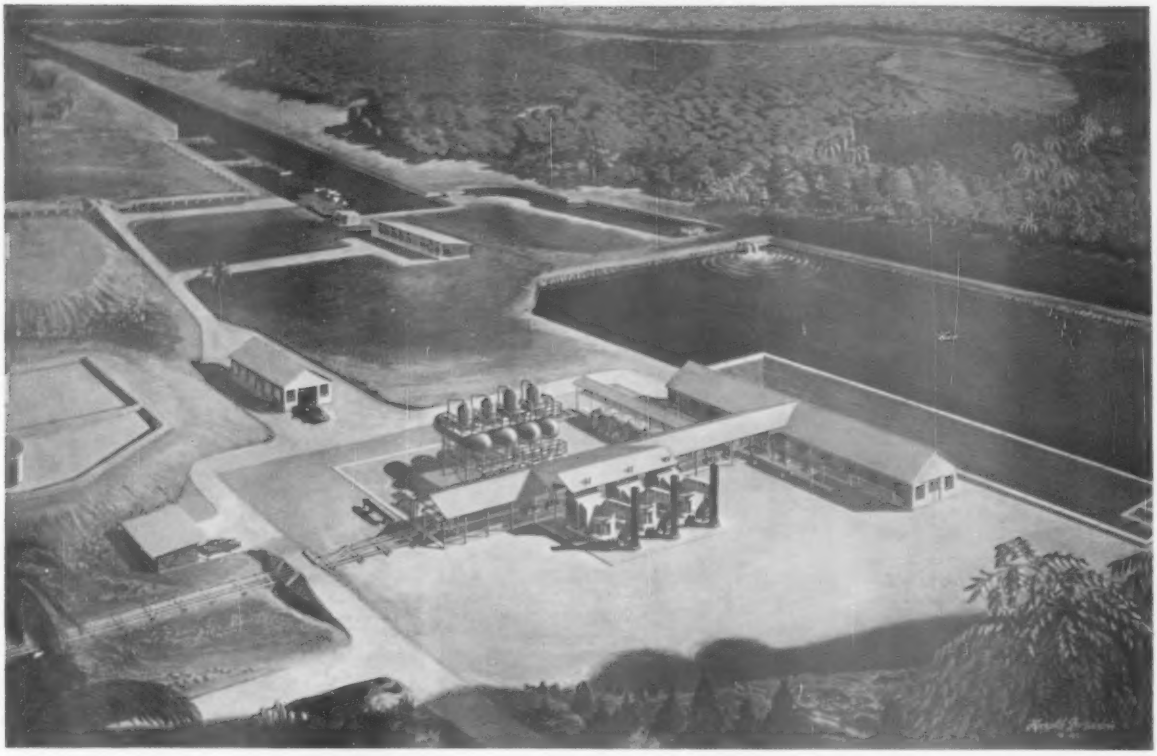
• **Southern Natural Gas Co.**

Project: 10 miles of 8-in. gathering lines between Napoleonville and Fort Jackson, La.

Status: Pending FPC approval.

Completion: August 1, 1957.

Spokane Natural Gas Co.



Sulphur From New Mining Project in Mexico of GULF SULPHUR CORPORATION

Since June, 1956, Gulf Sulphur has been producing sulphur by the Frasch method on the Isthmus of Tehuantepec. The completed project, designed and installed by Hudson, includes water treating and hot water plant, pipelines, relay stations, canals, docks, liquid sulphur barges, solid sulphur storage, and staff housing. This efficiently operating plant with complete dock facilities at Coatzacoalcos makes available to world markets the large sulphur reserves of Gulf Sulphur Corporation.

Production capacity is 1500 long tons per day with present plant facilities which are designed for expansion to produce 3,300 tons per day.

The completion of these facilities on the Isthmus of Tehuantepec adds to the long list of clients entrusting to Hudson the design, procurement and construction of major mining, chemical and petroleum plant projects in the United States, Mexico, South America, Canada, Europe, the Orient, and the Near East.

DESIGNERS AND CONSTRUCTORS OF MINING, CHEMICAL, PETRO-CHEMICAL AND OIL AND GAS PROCESSING PLANTS

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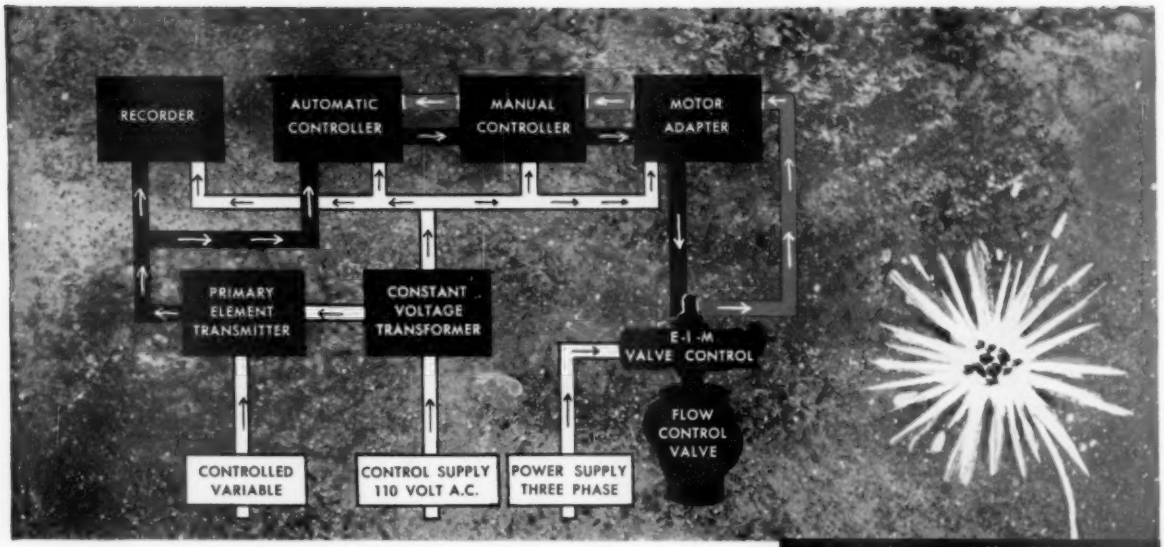

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EIM
FUTRONIC
VALVE CONTROL

E-I-M FUTRONIC valve control, the first all electric power operator for actuating control valves in throttling and regulating services.

The fully flexible electronic control system, utilizing A.C., D.C., motion inputs as well as conventional primary elements, is highly suitable for process and power instrumentation.

The FUTRONIC valve control system, is particularly valuable in meeting pipe line compressor station, pipe line pumping station and metering station requirements.

Units are adaptable for readout, cascading, computer and similar systems. Transmission distances of great length are permissible and it is possible to tie in with leased wire, micro-wave and other metering systems.

For complete details of the FUTRONIC valve control write

E-I-M

COMPANY, INCORPORATED

1840 Old Spanish Trail
Houston 25, Texas

Pipeline Patrol

Project: 400 miles of 1 through 24-in. distribution system at Spokane.
Status: Under way.
Contractor: **Hallmac Construction Co.**; V. L. Williams, spread superintendent, office at Spokane.
Completion: 1957.

- **Tennessee Gas Transmission Co.**

Project: 221 miles of 30-in., 101 miles of 26-in., and 10 miles of 24-in. looping from Portland, Tenn., to Greenup, Ky.; from Morehead, Ky., to Catlettsburg, Ky.; from Catlettsburg to Broad Run, W. Va.; from New Wilmington, Pa., to Mercer, Pa.; and from New Castle, Pa., to near Pittsburgh, Pa.
Status: Pending FPC approval.
Project: 51 miles of 26-in., 51 miles of 20-in., and 17 miles of 12-in. gathering lines from Kinder, La., to offshore fields in Gulf of Mexico.
Status: Pending FPC approval.
Project: 577 miles of 30-in. from Mississippi River delta area south of New Orleans to Portland, Tenn.
Status: Pending FPC approval.
Project: 76 miles of 24-in. between Coudersport, Pa., and Hamburg, N. Y.
Status: Pending FPC approval.

- **Texas Eastern Transmission Co.**

Project: 422 miles of 30-in. from near McAllen to Beaumont, Tex., to move imported Mexican gas; 45 miles of 24-in. laterals from McAllen to Provident City, Tex., 77 miles of 30-in. looping between Kosciusko, Miss., and Uniontown, Pa.; 147 miles of supply and sales laterals.
Status: Under way.
Contractor: **Houston Contracting Co.** has 121 miles of 30-in. between Angleton and Vidor, Tex., to start March 1, 1957. **H. C. Price Co.** has 70 miles of 30-in. **H. B. Zachry Co.** has 201 miles of 30-in. starting near McAllen and running northeast to near Angleton, Tex. **Grayco Constructors, Inc.** has 45 miles of 24-in. laterals from Blessing to Provident City. **Western Pipe Line, Inc.**, Austin, has 30-in. crossings at Nueces, Lavaca, and Carancahua bays. **Missouri Valley Dredging Co.**, Omaha, has crossings at Hinds and Guadalupe bays. **Altgelt Construction Co., Inc.**, has 100 miles of 3, 4, 6, 8-in. gathering lines in the Corpus Christi area.
Completion: Fall 1957.
Project: 17 miles of 8-in. and 3 miles of 6-in. from its 20-in. Baytown-Hankamer line to Alco-Mag field in Harris County, Texas.
Status: Has FPC approval, but is subject to commission review on appeal by parties to the proceedings.

- **Texas Illinois Natural Gas Pipeline Co.**

Project: 10 miles of 36-in. to loop existing single 30-in. near Joliet, Ill.
Status: Pending FPC approval.

- **Transcontinental Gas Pipe Line Corp.**

Project: 25 miles of 36-in. loops from Louisiana to South Carolina, 31 miles of 36-in. and 43 miles of 30-in. line.
Satus: Pending FPC approval.

United Gas Pipe Line Co.
Project: 48 miles of 20-in. from Deep Lake field to the Lake Charles, La., area.
Status: Under way.
Contractor: **Brown & Root, Inc.**

Foreign Crude-Oil Pipelines

Arabian American Oil Co.
Project: 140 miles of 20-in. from Safaniya field in the Persian Gulf to Ras Tanura, Saudi Arabia, plus an 8-in. gathering system in the gulf.
Status: Under way.
Contractor: **International Bechtel Brothers, Inc.**
Completion: April 1, 1957.

Bolivian Gulf Oil Corp.
Project: 160 miles of 10-in. and 43 miles of 8-in. from Sicascia to Arica on the Chilean coast.
Contractor: **Williams Brothers Co**
Completion: December 1957.

- **B-A Alberta Pipe Line, Ltd.**

Project: 35 miles of 8-in. to connect Drumheller field, Alberta, with existing lines running to Edmonton.
Status: Pending approval.

- **Colombian Petroleum Co.**

Project: 42 miles of 6-in. from Tibu field to Rio de Oro in Colombia.
Status: Planned.

- **Creole Petroleum Corp.**

Project: 87 miles of 30-in. from Tembalor field to Caripito in Venezuela.
Status: Planned.
Completion: 1959.
Project: 9 miles of 26-in. from Ule to La Salina in Venezuela.
Status: Planned.
Completion: Late 1957.

- **Interprovincial Pipe Line Co.**

Project: 151 miles of 20-in. to extend present line from Sarnia to Port Credit, Ont.
Status. To start May 1957.
Completion: September 1957.
Project: 33 miles of 24-in. from Kendal to Peebles, Sask.
Status: To start June 1, 1957.
Contractor: **Fulton-Banister, Ltd.**
Completion: July 31, 1957.
Project: 79 miles of 26-in. from Clearbrook, Minn., to Superior, Wis.
Status: To start June 1, 1957.
Contractor: **R. H. Fulton & Co.**
Completion: August 31, 1957.

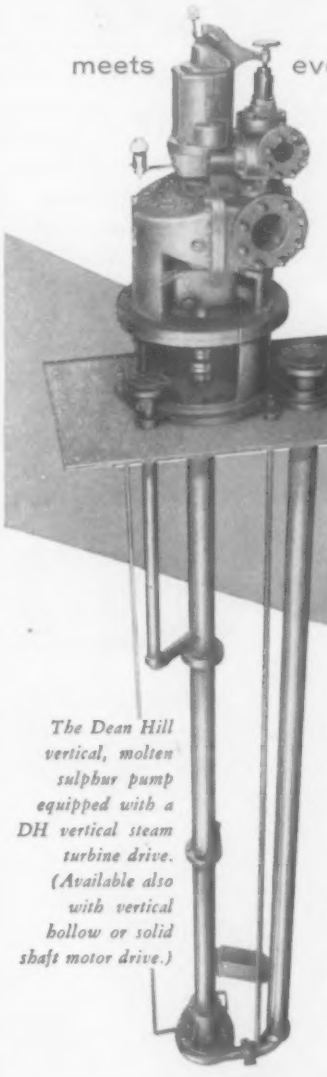
- **Iraq Petroleum Co.**

Project: About 600 miles of up to 40-in.

meets every requirement

the Dean Hill sulphur pump

low cost operation
heavy duty construction
reliability



The Dean Hill vertical, molten sulphur pump equipped with a DH vertical steam turbine drive. (Available also with vertical hollow or solid shaft motor drive.)

Like all Dean Hill products, this sulphur pump incorporates all of the features to give you years of trouble-free operation. Complete steam-jacketed line shaft and discharge column assures free flow at all times. Actual liquid sulphur lubricates bearings and shaft damping bushings. The Dean Hill sulphur pump is a compact, self-contained, rigid, smooth-running mechanism capable of superior service at all times. For complete information write today, without obligation.

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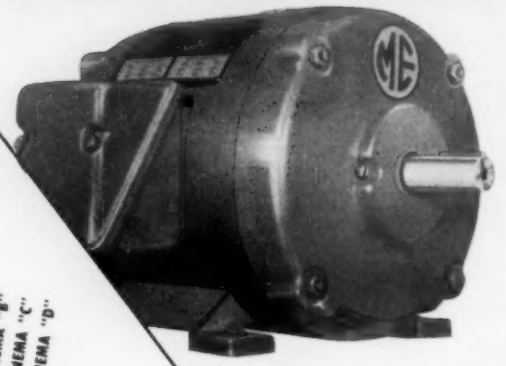
MOTORS — GENERATORS

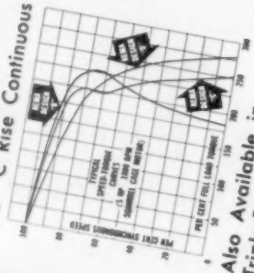
OILFIELD MOTORS



New NEMA Frames 182 thru 326U

MARATHON ELECTRIC

Specifications:
40° C Rise Continuous Duty
Designs:
NEMA "B"
NEMA "C"
NEMA "D"



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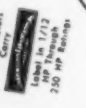

It's
✔ Splash-proof
✔ Drip-proof
✔ Guarded
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● EXPERIENCE . . . PROVEN PERFORMANCE. There is no substitute for the reliability of proven performance . . . Top Names of the Nation's Industry have proven ME performance in PRODUCING QUALITY PRODUCTS.

● VERSATILITY . . . WIDE RANGE OF DESIGN. Single Phase . . . Polyphase . . . Direct Current NEMA Standard . . . or Special Design ME can design to meet your special specifications.

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MOTORS
1/20 HP thru
2500 HP

GENERATORS
1/2 KW thru
2000 KW

Yours for the Asking

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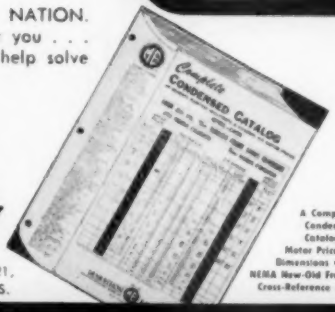
WAUSAU, WIS.



A Complete Condensed Catalog of Motor Prices & Dimensions with NEMA New-Old Frame Cross-Reference List.

SINCE 1913

MARATHON ELECTRIC

HOME OFFICE AND FACTORY, WAUSAU, WIS. FACTORIES AT ERIE, PA. AND EARLVILLE, ILL.

SALES OFFICES IN PRINCIPAL CITIES

Pipeline Patrol

from Kirkuk field through Iraq and Turkey to the Turkish port of Iskenderun on the Mediterranean sea.

Status: Proposed. Survey completed.

Israeli Government

Project: 125 miles of 8-in. from Elath to Beersheba.

Status: Under way.

Completion: March or April 1957.

• **Mene Grande Oil Co.**

Project: 11 miles of 6-in. from Elias to Fria, and 10 miles of 10-in. from Limon to Leona-Dacion lateral, Venezuela.

Completion: First quarter 1957.

Project: 59 miles of 30-in. from fields in Eastern Venezuela to Puerto La Cruz.

Status: To start in 1957.

Completion: First quarter 1958.

• **North-West Oil Pipelines Co.** (newly formed by six West German refiners, headed by affiliates of Standard Oil Co. (N.J.), and British Petroleum Co., Ltd.)

Project: 210-mile line from the refining centers in the industrial Ruhr area of West Germany to Wilhelmshaven.

Status: Planned.

Completion: 1959.

Pembina Pipe Line, Ltd.

Project: 100 miles of 3 to 12-in. gathering line in Pembina oil field.

Contractor: **Mannix, Ltd.**; T. Childress, spread superintendent, office at Drayton Valley, Alta.

Completion: Fall 1957.

Rangeland Pipe Line Co.

Project: 48 miles of 12-in. between Sundre and the Sylvan Lake in south-central Alberta.

Status: Under way.

Contractor: **Dutton-Williams Brothers, Ltd.**

Completion: August 1957.

• **Royal Dutch-Shell**

Project: 700-mile line across Europe from the Mediterranean to the North Sea, running through Eastern France, Luxembourg, West Germany, and Netherlands, and Belgium. Main trunk to be 30-in.

Status: Company is considering project together with several other companies.

Sinclair Oil Corp. and Socony Mobil Oil Co. Co.

Project: 211 miles of 20-in. from the Silvestre field in Barinas, Venezuela, to Puerto Cabello on Caribbean Sea.

Status: Under way.

Contractor: **Williams Brothers Sudamericano, Ltd.**

Completion: July 1957.

Union of Soviet Socialist Republic

Project: 2,300-mile Trans-Siberian crude and products line from Ufa and the Tuimaza fields in Bashkiria to Irkutsk near Lake Baikal.

Status: Under way.

• **Westspur Pipe Line Co.**

Project: 20 miles of 12-in. from Alida in southeastern Saskatchewan, to the Carnduff-Glen Ewen area to tap Cantal, Hastings, Florence, Carnduff, and Glen-Ewen fields; 34 miles of 4, 6, 8-in. gathering lines.

Status: Planned. Has requested permit from Board of Transport Commissioners.

Yacimientos Petrolíferos Fiscales (Argentina)

Project: 932 miles of 12-in. from Campo Duran to San Lorenzo.

Status: Under way.

Contractor: **TECHINT** (Compania Tecnica Internacional), Buenos Aires, has 90 miles.

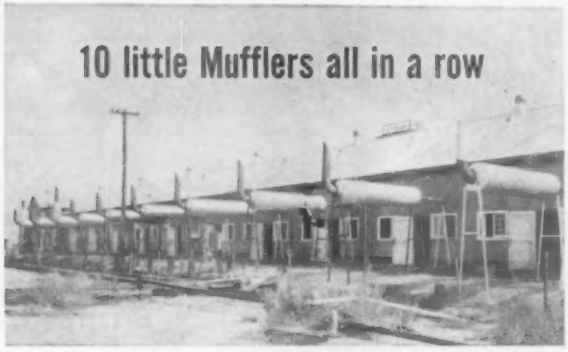
Project: 497 miles from Mendoza to Buenos Aires.

Status: Proposed.

Foreign Products Pipelines

Hydrocarbons Pipeline Co. (Subsidiary of Canadian Hydrocarbons)

Project: 800 miles of 6 and 8-in. L.P.G.



...and they're all Kittell's!

In areas where little or no exhaust noise can be tolerated, use Kittell residential-type silencers—like the ten horizontally-mounted KR's shown above. The unique features of Kittell silencers and spark arrestors are the result of more than 15 years of silencer design and fabrication experience. Models are available for almost all industrial, mobile and marine applications. Excellent delivery on both standard models and specials. When local dealers do not have the desired size in stock, shipment is made from the factory in from one to four days. Special engineering also available when required.

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Experience

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Here are some of the reasons why oil men call us "Bankers" and bankers call us "Oil Men": years of practical experience in *all* types of oil loans; service that includes Trust Dept. counsel. Remember, it pays to

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FIRST NATIONAL BANK & TRUST CO.

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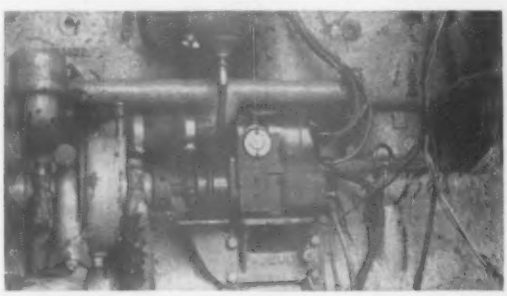
Pumping Station Network Uses Aeroquip Hose Lines

FOR QUICK REPLACEMENT, BETTER PERFORMANCE

When American Oil Pipe Line Company added several oil gathering systems around Houston to their huge pipeline network, existing pump engines were completely overhauled. Troublesome rigid tubing on the engines was replaced with Aeroquip Flexible Hose Lines.

Ease of installation and the ability to withstand vibration have now made Aeroquip the choice for all replacement lines. And, American Oil mechanics carry Aeroquip field kits for quick fluid line replacement at small pumping installations throughout the systems.

Use Aeroquip Hose and Reusable Fittings for replacements on all stationary and mobile equipment. See your supply store or write to us.



At American's Lake Creek #3 station, the oil filter on this big engine was a critical spot for vibration failures until Aeroquip Flexible Hose Lines were installed.

Aeroquip

REG. TRADEMARK

AEROQUIP CORPORATION, JACKSON, MICHIGAN

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AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A., CANADA AND ABROAD

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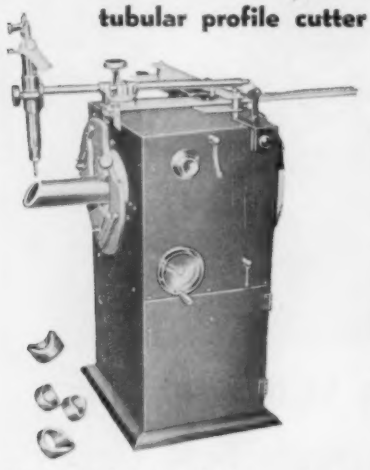

It's versatile! You can make all types of precision flame cuts on pipe or tubing with this machine; angles, miters, saddles, bevels, spiral slots, notches, cams, serrations, and many different shapes or profiles.

See your welding supply dealer, or write direct for descriptive folder.

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Completely Air-Conditioned
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BUSINESS and PLEASURE in TULSA means . . .

THE MAYO
LD 381 TULSA's world-famous HOTEL

Pipeline Patrol

line from near Edmonton, Alta., to Fort William, Ont.

Status: Has permit from Parliament of Canada. If approved by Federal Board of Transport Commissioners and the Alberta Petroleum and Natural Gas Conservation Board, work will start early 1957.

Construction consultants: **Dutton-Williams Brothers, Ltd.**, Calgary, and **A. D. Little & Co.**, Boston.

Imperial Oil, Ltd.

Project: 37 miles of 12-in. from Waterdown to North Toronto, Ont.

Status: Under way.

Contractor: **Majestic Contractors, Ltd.**, Odis Hare, spread superintendent, office at Cooksville, Ont.

Israeli Government

Project: A 6-in. line from the Haifa refinery to Tel Aviv.

Completion: Late 1957.

National Iranian Oil Co.

Project: 573 miles of 10-in. from Ahwaz to Teheran, Iran.

Contractor: **Enterpose of Paris,** has northern 236 miles. Southern section completed

• **North Atlantic Treaty Organization (NATO)**

Project: 2,000 miles of lines to airfields in parts of Europe.

Status: Under way.

Contractors: **Associated Pipeline Contractors, Inc.,** has 450 miles from Iskenderun, Turkey, to Batman. **TECHINT** (Compagnia Tecnica Internazionale), Milano, Italy, has 205 miles of 4-in. from Bandirma to Eskisehir, Turkey, and 250 miles of 8-in. from Antalya to Eskisehir. Bids were taken in January 1956 on 300 miles of 12-in. between Marseille and Langres, France. Taking bids on 275 miles in northwestern France: 54 miles of 2-in. from Langres to Mirecourt, 63 miles of 2-in. from Mirecourt to Phalsbourg, 47 miles of 8-in. from Mirecourt to Metz, 30 miles of 8-in. from Phalsbourg to Deux Ponts, 35 miles of 8-in. from Phalsbourg to Strasbourg.

Foreign Natural-Gas Pipelines

• **Alberta Gas Trunk Line Co., Ltd.**

Project: 637 miles of 34 to 16-in. gathering lines in Alberta.

Contractor: **Dutton-Williams Brothers, Ltd.**, has preliminary studies, design and management-engineering. **Mannix, Ltd.,** has crossing of Red Deer River near Cavendish. Alta., J. Hysuick, spread superintendent, office at Empress.

Status: Mannix, Ltd., work to be completed March 1957.

Andes Pipeline Corp. (Subsidiary of Glenn McCarthy, Inc.)

Project: 500 miles of 12-in. from McCarthy's Bolivian concession to the Chile copper-mining area.

Status: Proposed.

Contractor: Will do own work.

• **Attock Oil Co.**

Project: 60 miles of line from Dhulian field to Rawalpindi in West Pakistan.

Status: Planned.

Cia. Shell de Venezuela.

Project: 177 miles of 20-in. from La Paz field in the Maracaibo district, to the Cardon refinery on Paraguana Peninsula, to fuel refinery furnaces.

Status: Under way.

Contractor: **Williams Brothers Co.**

Completion: 1957.

• **Empresa Nacional Del Petroleo.**

Project: 80 miles of 10-in. from Concon to Santiago, Chile.

Status: Planned.

Inland Natural Gas Co., Ltd.

Project: 304 miles of mainline and 25 miles of laterals from Savona to Nelson, B. C.; 150 miles of 12-in.; 112 miles of 10-in.; 67 miles of 6-in. Also will build 400 miles of distribution piping in 31 towns.

Status: Under way.

Contractor: **Dutton-Williams Brothers, Ltd.**; Pat Campbell, project manager, office at Penticton.

Completion: October 1, 1957.

Petroleos Mexicanos

Project: 130 miles of 22-in. to parallel a 14-in. line from Reynosa to Monterrey in northern Mexico.

Status: Planned.

Saskatchewan Power Corp.

Project: 300 miles of 1 to 20-in. distribution system at Regina City.

Status: Planned.

Status: Will start in 1957.

Contractor: **Fulton Banister, Ltd.**

Completion: October 15, 1957.

South Alberta Pipe Line, Ltd.

Project: 150 miles of 8-in. from Etzikom

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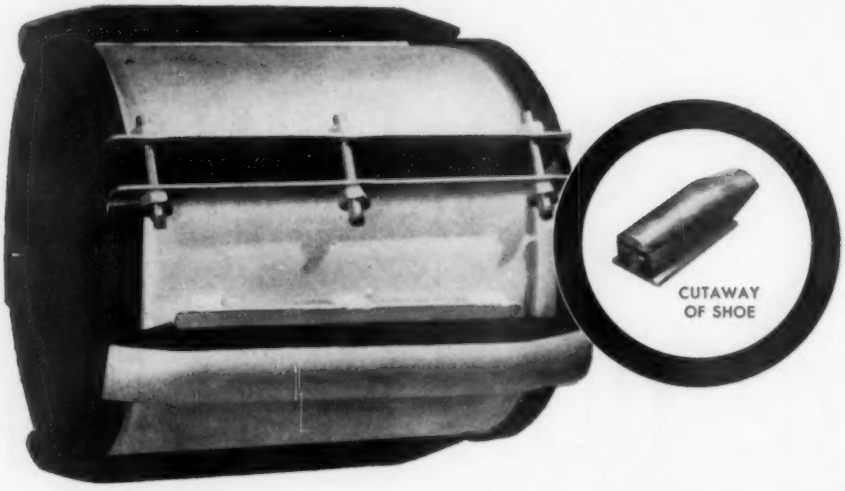
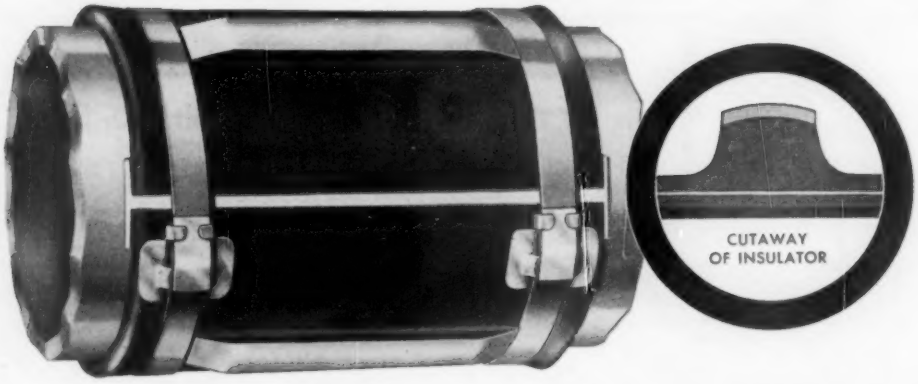
Model 55 Maloney Insulators for LARGE JOBS



Model 56 Maloney Insulators for Small Jobs



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Because they are bonded metal-to-neoprene-to-metal, Maloney Insulators provide good shock-absorption, plus flexibility to compensate for pipe shifting.

Streamlined "sled-type" steel runners make for easy entry into the casing, and prevent hanging-up on casing welds as pipe is being run.

Model 55 Maloney Crossing Insulators, in all sizes through 36", are fitted with an extra-wide steel band for positive grip. Model 56, for pipe sizes through 12" with 2" nominal pipe size differential, are fastened to the carrier pipe with stainless steel bands. Both types offer greater dependability—greater protection against corrosion with high dielectric strength neoprene, and against physical damage with steel runners—than any other insulator on the market. Maloney Crossing Insulators are in use on most of the country's major pipelines.

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Pipeline Patrol

field to serve a nitrochemical plant to be built near Medicine Hat, Alta.

Status: Filed for permit.

Sui Gas Transmission Co.

Project: 188 miles of 16-in. from Sui gas field to Moultan, Pakistan.

Status: Under way; to be extended later to Lahore with branches at Kot Addu, Jhang, Magiana, and Montgomery.

Contractors: **Pakistan Constructors,** a joint company of **Morrison-Knudsen** of Boise, Idaho, and **William Press, Ltd.,** of London.

Technical Office of Hydrocarbon, Ministry of Mines and Petroleum, Government of Venezuela.

Project: 207 miles of 26-in. from Anaco fields to Caracas.

Status: Under way.

Contractor: **Fulghum Contracting Corp.** will be consultants; **Petrogas, S. A.** will engineer and construct the line.

Completion: Spring 1959.

• **Trans-Canada Pipe Lines, Ltd.**

Project: 574 miles of 34-in. from the Alberta-Saskatchewan border to Winnipeg. (First part of 2,250-mile line from Alberta to Toronto and Montreal.)

Status: Under way.

Contractors: **Majestic Contractors, Ltd.** (104 miles from Burstall to Stewart Valley, Sask., R. L. Leonard, spread supt., office at Cabri.; **Canadian Bechtel, Ltd.** (110 miles from Swift Current to Moose Jaw, Sask., J. L. Work, general supt., office at Moose Jaw, and 54 miles from Partoze La Prairie to Winnipeg); **Mannix, Ltd.** (90 miles from Moose Jaw to Welseley, spread superintendent, T. Anderson, office at Montmartre, Saskatchewan); **Dutton-Williams Brothers, Ltd.** (97 miles from Deveren to Moosomin, under way, to complete August 1957). **Price-Poole of Canada, Ltd.** has 100 miles from Miniota to near McGregor to start in 1957.

Completion: Late summer 1957.

Union of Soviet Socialist Republic.

Project: 900 miles of 26-in. from Stavropol in the Northern Caucasus to Moscow. The line, larger than Russia's other two major gas lines which are only 16 and 18-in., will serve Voroshilovgrad, Voronezh, Tula, Yelets, and Serpukhov.

Status: Under way; over 50 per cent completed.

• **Westcoast Transmission Co., Ltd.**

Project: 650 miles of 30-in. from Peace River area, Canada, to Sumas, Wash.

Status: Under way. About two-thirds completed.

Contractors: **Dutton - Williams Brothers, Ltd.,** has 120 miles from Taylor, B. C., to Azouzetta Lake, completed; **Mannix, Ltd.,** has 110 miles between Huntingdon and Merritt, G. Lyons, spread superintendent, office at Hops, B. C.; **Canadian Bechtel, Ltd.,** has 210 miles from Alexandria to Pine Pass, B. C., H. F. (Hank) Mogg, spread man, office at Quesnel, B. C.; **R. A. Conyes Construction Co.,** has 210 miles; **River Construction Corp., Ltd.,** has under way 150 miles of gathering lines in northern Alberta and British Columbia; **Marine Pipeline & Dredging, Ltd.,** has Fraser and Peace River crossings.

Completion: Dutton-Williams section completed. R. A. Conyes section and Canadian Bechtel section to be completed September 1957. Marine Pipeline work to be completed April and May 1957.

Project: 174 miles of 30-in. from Savanna Creek area to the Canadian-Idaho border.

Status: Proposed.

• **Yacimientos Petroliferos Fiscales (Argentina)**

Project: 1,056 miles from Campo Duran to Buenos Aires.

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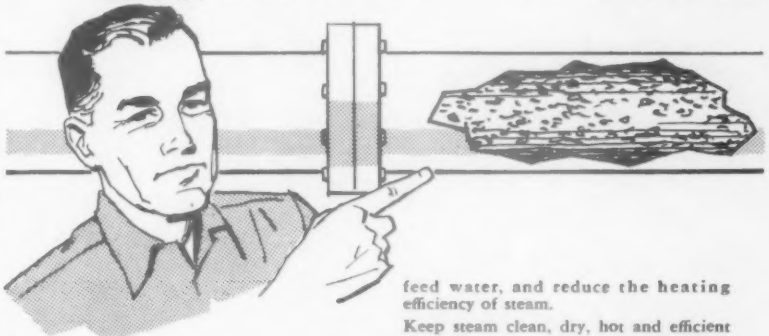

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SATURDAY, AUGUST 25, 1956.

SALAM

THE STAFF WEEKLY NEWSPAPER AND OFFICIAL NOTICES OF THE BRITISH MALAYAN PETROLEUM COMPANY LTD. AND SARAWAK OILFIELDS LTD.

NEW SHIFT TEAMS WILL RUN LUTONG REFINERY

Dick — It looks like Security Bits are setting all kinds of records. Better run them on your next well. JCM

A reorganisation of staff responsibilities took place last Monday at Lutong Refinery designed to streamline supervision of the refinery's processing operations.

Seven Lutong workers in the refinery have been promoted to Regional Staff: Peter Mayor (Distillation Assistant Foreman), Abidin Sahat (Distillation Assistant Foreman), Ho Thiong and Lawen ak. Chundi (Laboratory Assistant Foremen), Ong Kim Tiat and Aman bin Salih (Installation Assistant Foremen), bin Jaludin (Local Delivery Assistant).

All routine refinery operations are now controlled by a series of Shift Teams, comprised of a Supervisor, a Foreman, and three Assistant Foremen — Distillation, Installation and Laboratory.

As from September 5, it is planned to transfer the Accounts Section from the refinery, which will work under the Refinery Technologist and the Senior Installation Supervisor. From that date, an Oil Accounts Clerk will join each Shift Team. Thereafter, these 'Shift Teams' will be responsible for all routine refinery operations — crude receipts, distillation runs, tank farm movements, ships, laboratory testing and oil accounting. The same men will work together in the same shift cycle and will thus keep together as a team.

By grouping all routine activities under the Shift Team, Technologists and Section Heads will have more time to concentrate on programming, future planning, and the efficient administration of their sections.

The reorganisation is the result of the growing refinery. Two years ago, crude oil receipts were only 75% of the present figure; Seria supplies nearly a third of the crude and there was no natural gasoline being processed and no naphtha was produced. Furthermore, the sea-loading pipeline was still in use and relatively small oil tankers were calling at Lutong.

Today the refinery deals with spiked naphtha, two grades of gasoline, an extra residue grade and faster loading of much larger ships with night berthing equipment. Forward programming is closely scheduled with Singapore, Pladju, Geelong and Clyde — more products and closer coordination.

Parallel with these advances, there has been the necessity to step up efficiency, and increase the study of economics, pollution and waste problems.

These expanding activities have meant more work for the Section Heads and Technologists and the new reorganisation is designed to free them from the routine day-to-day operations.

WELL DRILLED IN NINE DAYS

Well 439 in the Labour housing area has been the fastest-drilled medium-depth vertical hole in the Seria Field to date.

The number of days from spudding-in to reaching the final depth of 5576′ was just over nine days. Well 423 reached this depth 10½ days after spudding-in, and Well 405 took 11 days.

A new type of bit was used for the first time in the area—a long-toothed Security S3J tricone jet bit.

Well 439 is a vertical well, and the average net rate of penetration in 9⅞″ hole (i.e. after setting 10¾″ casing) was 67.4 ft/hour, from 1505 feet to 5107 feet, compared with 64 ft./hour over the same interval in the previous fastest well, No. 423.

Five bits were used to drill from 1505′ to 5556′ — an average of 810′.

The drillers were: A.A. Ahmed Assan, M. Krishnan, K. R. Govindan, Jamal Mohd. (relief driller).

Among the

Drilling Contractors

New Contracting Firm to Drill in Ark.-La.-Tex. Area

Hummingbird Drilling Co. is a newly formed contract-drilling firm operating in the tri-state area of Arkansas, North Louisiana, and East Texas.

Headquarters are at 682 Long Drive, Houston. Operating office and yards are at 604 Dudley Road, Magnolia, Ark. The firm is starting with two rotary rigs, one rated for 3,000-ft. and the other for 5,000-ft. drilling.

Principal owners are W. A. Byrd, president; W. A. Horner, vice president; and Gilbert M. Turner, vice president and secretary. Byrd lives at Magnolia. Horner and Turner are at Houston.

Coulston Drilling Co., Gladewater, Tex., is on a new 7,000-ft. Rodessa operation in the Vickie Lynn area, 5½ miles southwest of Jefferson, in Marion County, East Texas, where it is drilling for Whelan Brothers, of Marshall, Tex. Current job is at 2 Nehls, in the Samuel T. Watts Survey.

Miller & York, Bakersfield, Calif., have a rig on a wildcat location a mile west of Pyramid Hills field, in the McLure Valley area, Kings County, California. Drilling is on contract for Pearson-Silbert Oil Co., which recently extended its operations from Texas and the Rocky Mountain region into California. The new test, 43-30 Orchard, in 30-24-18, is projected to the Avenal sand about 4,500 ft.

Fowler Drilling Co., Long Beach, Calif., is getting started on a 9,000-ft. test it has contracted to put down for General Exploration Co. in the McNalley Ranch area, south of West Coyote field, in Orange County, southern California. This is General's second test on its Emery lease, in 24-3s-11w, and the third test for the immediate area.

Deckard Drilling Co., Shreveport, has two new operations going in the Heidelberg area, Jasper County, eastern Mississippi. Both are at outpost locations. One is a contract job for R. Merrill Harris and Southern States Oil Co. at 1 Ross, in the graben area between East and West Heidelberg fields, and about a mile from the nearest previous test. The other is a partnership deal with Robert Womack and Earl Wilson at 1 Collins, about 1¾ miles northwest of production in West Heidelberg field. Both are Eutaw tests, the first scheduled for 5,200 ft., and the other for 5,500 ft.

Rockhill Drilling Co., San Antonio, has a new operation under way for George H. Coates in the Tabasco area, in southwestern Hidalgo County, in Texas' Rio Grande Valley. Location is on Coates' King lease, about ¾ mile northeast of Tabasco townsite.

Allen & Morris, San Antonio, are drilling on another Texaco contract in the Monte Pasture area, 11 miles northeast of Raymondville, on the Kenedy-Willacy county line, in the lower coastal region of Southwest Texas. Location is at 12 Yturria, about 2,000 ft. west of Texaco's discovery well, completed last August as a 26,500,000-ft. gasser in an 8,400-ft. sand.

C. B. Webster Drilling Co., Houston, is under contract for another deep test Southern Natural Gas Co. has scheduled for the Franklin area in St. Mary Parish, Coastal Louisiana. Latest job is on an outpost location, listed as 1 Foster 2 Lucia Sand Unit A. It is in 38-15s-9e. Contract is for 12,000 ft.

Southland Drilling Co. is contractor on a new wildcat operation Hillcrest Oil Co. and George H. Coates are starting 9 miles northwest of San Diego, in northeastern Duval County. It is a 5,000-ft. test at 2 E. A. Parr, in the T. C. Rogers Survey 22.

Dixilyn Drilling Co., Odessa, Tex., has contracted for another deep wildcat test Gulf Oil Corp. has planned for its South Timbalier Block 21 area in the Gulf of Mexico, off Terrebonne Parish, Louisiana. Location is several miles out from production in the large Timbalier Bay field, at the mouth of Timbalier Bay. Permit provides for a 12,500-ft. test, listed as 2-D State Lease 1423.

Goldrus Drilling Co., Houston, has contracted to drill Lee Brothers Oil & Gas Co.'s second well in the West Holmwood area, 10 miles southeast of Lake Charles, in southeastern Calcasieu Parish, southwestern Louisiana. Location, at 1 Farmers, in 28-10s-7w,

Protects threads—prevents galling and seizing—gives tight seals—permits easy separation—lengthens drill string life. These are reasons why 'Bestolife Lead Seal Tool Joint and Casing Compound has been the standard of the oil country for over twenty-five years. Unconditionally guaranteed.

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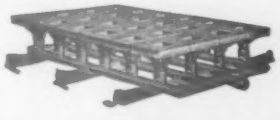

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is the east offset to the operator's discovery well, completed last May as a gas-condensate producer from a 10,550-ft. sand. The new test, the first confirmation attempt, is projected to 11,300 ft.

Rush Drilling Co. has a new contract operation in the Gordon area, southern Beauregard Parish, southwestern Louisiana. It is a 6,900-ft. test for Union Oil Co. of California at 1 Bertrand, in 34-6s-10w, on the southwest flank of production.

L & W Drilling Co., Mission, Tex., is keeping a rig running for P. H. Welder in McCook field, ¾ mile southeast of McCook, in Hidalgo County, South Texas. Newest job is at 1-A Wiesehan "A," in Section 2. It is a 6,000-ft. test about ½ mile from production.

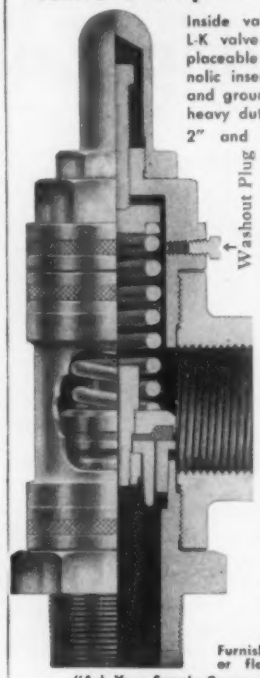
H. L. Rowley, Inc., Shreveport, is scheduled for a 6,000-ft. Wilcox test to be drilled on the southwest flank of McBride salt dome, in Jefferson County, southern Mississippi. It is a contract job for Lee Oil & Exploration Co. at 1 Greer, in 10-9n-4e.

Knight & Williams Drilling Co. is contractor on a wildcat test Porter Sesnon and others are starting about 1½ miles northwest of South Cuyama field, in southern Santa Barbara County, California. Location is listed as 83-22-A Russell, with spot in 22-10-27. Plans call for a 6,000-ft. objective. It is a Richfield Oil Co. farmout.

Sunnyland Contracting Co., Rayne, La., has a rig under contract to C. Porter Johnson, of Laurel, Miss., for a 7,000-ft. test 6½ miles east of Quitman, in Clarke County, eastern Mississippi. Location is on the operator's International Paper Co. lease, in 6-2n-17e. Sunnyland has another new Mississippi operation under way for its own account. It is a 6,900-ft. Wilcox test northeast of West Locust Hill field, in Adams County, on the west side of the state.

Chiles Drilling Co., Alice, Tex., is starting a 6,000-ft. test for its own account at a wildcat location 14 miles north of San Diego, in northeastern Duval County, Southwest Texas. Location is on its Perfecto Mendosa lease, in the F. Fabela Survey 6. Chiles also has two more contract jobs scheduled for the Captain Lucey area, 6 miles northwest of Agua Dulce, in Jim Wells County. One is a 5,500-ft. well for Lyman-Damascus Operations at 2 Hayden-Reeves, and the other a 6,200-ft. well for Tex-Penn Oil & Gas Corp. at 4-A Blundell.

L-K RELIEF VALVE
Positive • Simple • Economical



Inside valve uses regular L-K valve design with replaceable laminated phenolic insert and hardened and ground steel seat and heavy duty steel body.

2" and 2½" carried in stock. Other sizes can be furnished quickly on receipt of order. Laminated phenolic valve insert will not "freeze" on hardened steel valve seat.

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Furnished with screwed or flanged connections.

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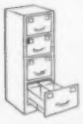
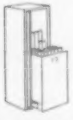
STRIP LOG CABINET G-34, G-36

Each drawer of this sturdy, all-steel KRAFTBILT cabinet can hold 2,500 cardweight well logs filed on edge. No space is wasted because roller-bearing extension arms slide all the way out.

Built in 3-drawer sections with separate tops and bases to permit vertical stacking. Model G-36 files logs scaled to 6,000 feet (up to 65" long).


Electric Log Cabinet E-24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SHOWCASE...

NEW EQUIPMENT

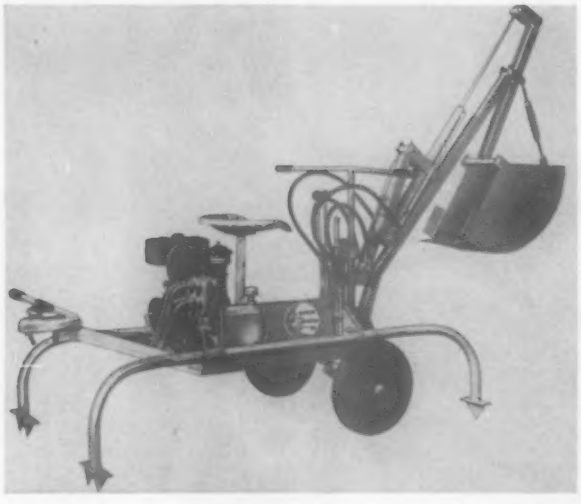
Mobile Rotary Drill Handles Four Types of Operations

This new mobile rotary drill, the B-52 Pacemaker, handles auger boring, core and percussion drilling, and soil-sampling tasks with equal speed and versatility, according to the maker.

Its hollow-stem auger permits undisturbed soil sampling without withdrawing the auger from the hole. Thus, a driller can take samples without interrupting boring operations. Coring may also be continued through the hollow stem of the auger after rock is reached.

Self-powered, it can generate a force of up to 5 tons. Its twin-hydraulic feed responds to fingertip control. The unit handles 6-ft. sectional augers in sizes from 3 to 24 in. It bores to 150 ft. in unconsolidated materials, to 600 ft. with N rods, and 1,000 ft. with A rods.

Its other features include: (1) a completely centralized one-man-operated control panel to increase operator efficiency, (2) an "off-the-hole" movable hydraulic base that cuts drilling and withdrawal time, (3) a 22-ft. tower that permits withdrawal of rods in 20-ft. lengths and jack-knifes to a horizontal traveling position, and (4) a new spindle type of drive tube that permits easy accessibility to both auger couplings and A or N-rod chucks. **Write or call: Mobile Drilling, Inc., 960 North Pennsylvania Street, Indianapolis, Ind., for more information on the B-52 mobile rotary drill.**



New Backhoe Eliminates Hand Digging

This new portable Ditch-Witch backhoe, designed to eliminate hand digging, is capable of digging to a depth of 5 ft. for trenches, bell holes, and excavations, the maker states.

It is a trailer unit that may be towed behind a car at normal road speeds. Weighing 500 lb., the backhoe has its own gasoline power unit and hydraulic system.

Its potential uses include: (1) digging service lines, (2) digging bell holes for maintenance and connections on pipelines and mains, (3) digging footings

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to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

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Described in The OIL AND GAS JOURNAL - Issue of Feb. 18, 1957

NAME..... TITLE.....

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ADDRESS.....

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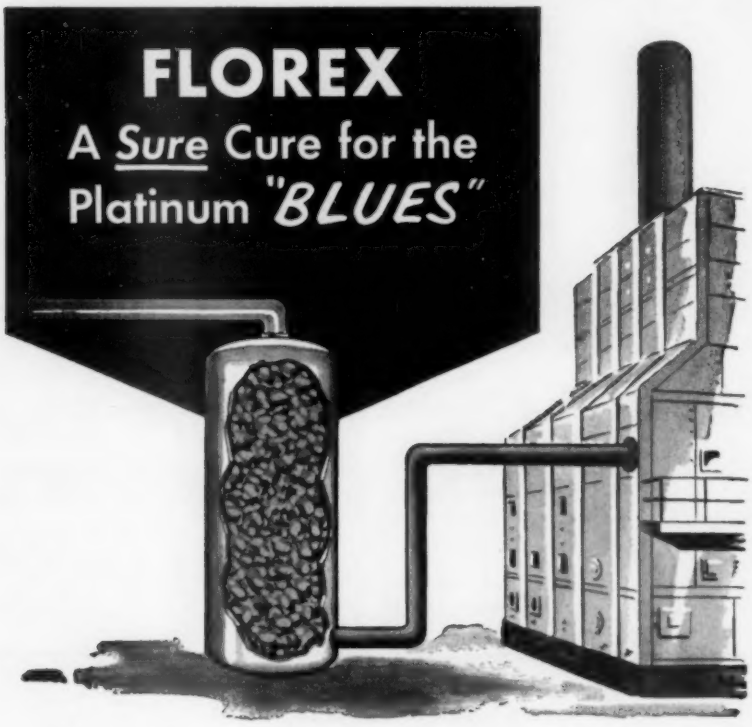
New Equipment

and foundations, and (4) other applications where portable powered digging is desired.

The backhoe is especially suited to digging in soils where gravel and loose rock are prevalent, the maker points out. **Write or call: Charles Machine Works, Perry, Okla., for more information on the portable Ditch-Witch backhoe.**



The growing use of platinum catalysts in reforming feed stock emphasizes the importance of pre-removing trace metals such as arsenic, lead and sulphur compounds. Platinum catalysts are poisoned by these substances in quantities even as small as ten parts per billion.

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L.P.G. Tank Provides Greater Payloads

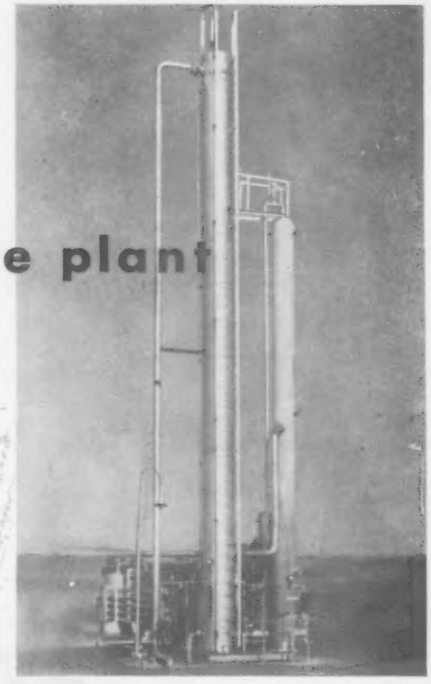
This new Master Max L.P.G. tank is fabricated of T-1 steel, a lightweight high-tensile-strength steel approved for L.P.G. The tank is designed to obtain minimum dead weight, decrease wind resistance, and increase capacity for greater payloads, according to the maker.

The tank is available with a choice of tractors and is fully equipped. **Write or call: Master Tank & Welding Co., 1612 Singleton Boulevard, Dallas, Tex., for more information on the Max L.P.G. tank.**

Earth-Boring Machine Offers Increased Boring Speed

The boring speed of this Hydrauger horizontal earth-boring machine has been upped as much as 40 per cent by redesigning it and incorporating a high-torque Ingersoll-Rand multivane air

portable gasoline plant



The McNamar portable gasoline plant is designed to control the hydrocarbon content of sales gas and to economically recover natural gasoline and LPG.

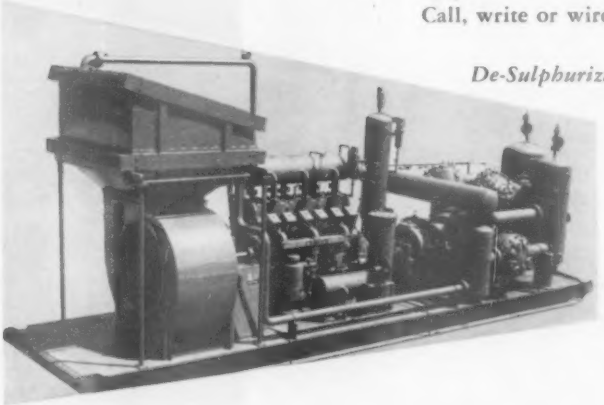
The plants are also designed to fractionate the distillate, if desired. The ease of moving from one location to another, the simplicity in design, and the dependable operation of this unit are factors that greatly reduce operating and maintenance costs.

The usage of the McNamar portable gasoline plant is extremely flexible. The unit can be completely operated automatically, saving time and costs.

For dependable, economical gas plant operation, you can be assured of complete satisfaction when you purchase McNamar quality equipment.

Call, write or wire McNamar for further information.

De-Sulphurization Plants • *Glycol and Solid Dessicant Units*



The McNamar Joy-Gas Compressor units are available in one, two or four cylinder models. Extremely portable, the unit can be moved on a tandem semi-trailer without disassembling.

McNAMAR BOILER & TANK CO.

BOX 868 — TULSA, OKLAHOMA CHerry 2-6291

New Equipment

motor, the maker claims. This is a special motor, built to bore and cut through the tough tree roots often encountered while boring underground for pipe installations.

The principle of operation behind the earth-boring machine is classed as wet-hole boring. Water is forced through the hollow-steel boring-bar sections. In passing through, it cools the cutting bit, washes cuttings from the hole, and muds the hole walls.

Cooling the bit allows the operator to crowd the bit into formation. And it lengthens bit life and increases boring speeds, which can save time in all types of earth formation, the maker points out. Because it uses air power below the surface, the machine is less hazardous to workers than electric or gasoline powered units.

The straight, open hole produced by the machine allows the installation of many kinds of pipe, including asbestos-cement types with O-ring couplings. The machine is available in several sizes and modifications. The larger machines bore holes of 2 through 24 in. for distances up to 250 ft. **Write or call: Hydrauger Corp., Ltd., 681 Market Street, San Francisco 5, Calif., for more information on the horizontal earth-boring machine.**

Tractor Cab Gives Operator Protection

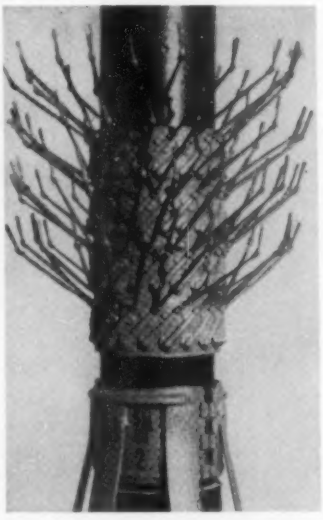
Protection for operators from wind, rain, and snow may be obtained with this new rugged all-weather cab designed for most makes of industrial tractors. The cab is custom built, enabling it to be quickly and easily installed.

It is designed to fit the tractor itself and most makes of front-end loaders, backhoes, or combinations of front and rear-mounted equipment. One cab enables the use of all tractor equipment.

It's made with a heavy-gage steel top and canvas side and rear panels. The panels can be easily removed or rolled up for summer use. A safety-glass windshield and skylight and heavy Vinyl windows permit visibility in all directions. All operating controls of the tractor and the equipment mounted on the tractor are inside the cab.

Packed in kit form, the cab is quickly and easily installed. **Write or call: Northeast Equipment, Inc., Brookfield Street, Worcester, Mass., for more information on the all-weather tractor cab.**

•



Down-Hole Tool Aids Cement Placement

During cementing operations when it isn't practical to move casing up and down or rotate it to remove mud cake from permeable formations, these B and W Multiflex clusters can be helpful. They help achieve an effective cement seal, the maker states.

They do this by creating an improved condition for cement placement by causing turbulence, preventing channelling and agitating the gelled mud in the enlarged shale sections. **Write or call: B & W Inc., P. O. Box 5266, Houston 12, Tex., for more information on Multiflex clusters.**

Send this **Showcase Coupon**

to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

.....

.....

Described in The OIL AND GAS JOURNAL - Issue of **Feb. 18, 1957**

NAME.....TITLE.....

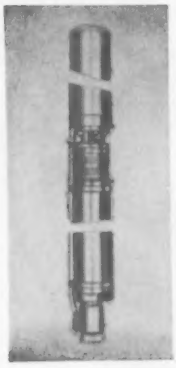
COMPANY.....

ADDRESS.....

CITY.....STATE.....

DATE.....

Five-Hp. Oil-Well Pump Delivers 800 Bbl. Per Day



This new 5-hp. Reda oil-well pump will pump from depths as great as 1,500 ft. Too, it will provide capacities above 800 bbl. per day, the maker states.

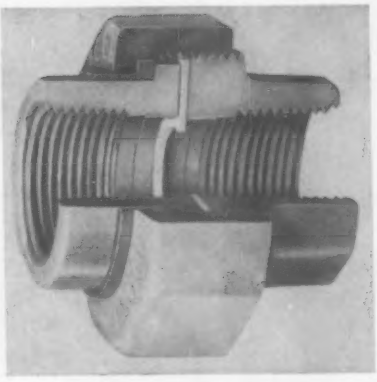
Available in two models for different ranges in well depth, the pump will fit in well casings as small as 5½ in. **Write or call: Reda Pump Co., 504 East First, Bartlesville, Okla., attention of Advertising Department, for more information on the 5-hp. oil-well pump.**

•

New Instrument Tubing Is Flexible, Can Be Buried

A new fire and impact-resistant instrument line harness, known as Dekoron Super Poly-Cor, can be used in chemical processing, petrochemical plants, and refineries. Since it is flame retardant it can be used in hazardous areas where flash fires or welding splatter is a danger. It is impact resistant and can be buried in the ground.

A heavy thermal and shock barrier covered with braided, fireproof asbestos extrudes over the bundle. The whole assembly is then covered with a flame-retardant outer sheath. Dekoron Super Poly-Cor is available in 100 and 500-ft. coils. **Write or call: Dekoron Products Div., Samuel Moore & Co., Mantua, Ohio, for more information on Dekoron Super Poly-Cor.**



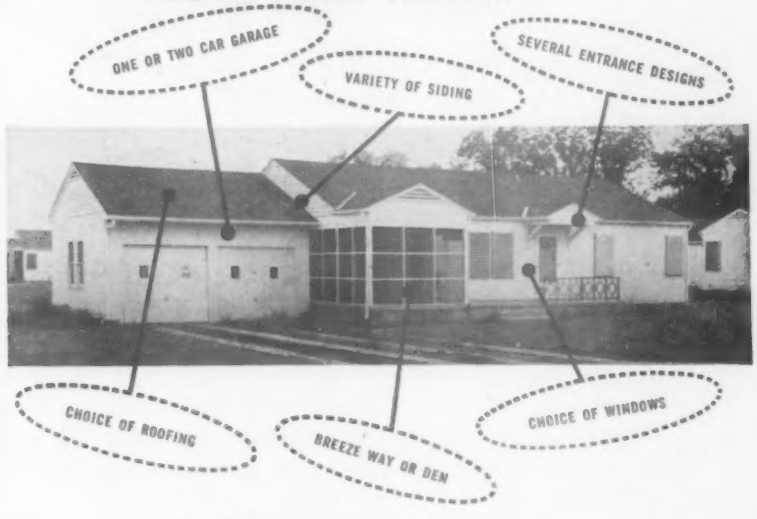
SHOWCASE . . .

New Equipment

Pipe Unions Prevent Electrolytic Corrosion

The tail piece, thread piece, and nut are drop forged from carbon steel in accordance with A.S.T.M. material specifications A-105 Grade 2. The insulating sleeve separating the tail piece and nut is made of fabric-reinforced phenolic resin which is noted for its

VARIETY makes individual and attractive STURDYBILT homes



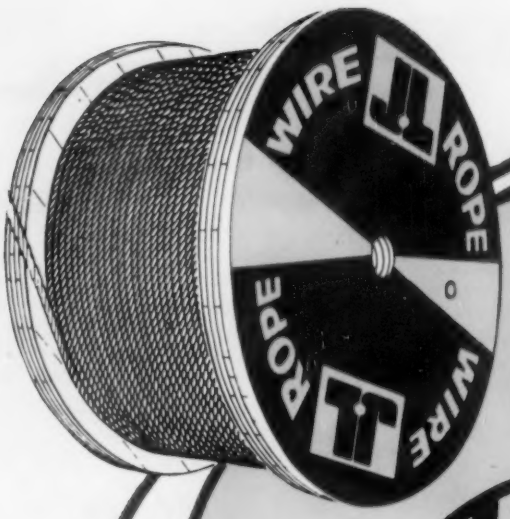
Industrial housing developments need not be made of "look alike" houses. Even when floor plans are the same, exterior appearances can be changed so each STURDYBILT Prefabricated home may have an attractive, individual personality of its own.

Specify STURDYBILT Prefabricated Homes for every field housing need.

STURDYBILT PREFABRICATED, DEMOUNTABLE HOUSES

SOUTHERN MILL & MANUFACTURING CO. • TULSA, OKLAHOMA

STURDYBILT HOUSES COMPLY WITH COMMERCIAL STANDARD CS125 OF THE NATIONAL BUREAU OF STANDARDS FOR PREFABRICATED HOMES



Coiled Power!

Energy (physics) means "Capacity for performing work."

And that, in a nutshell, is J&L wire rope.

There IS a difference. You can pick up a good wire line anywhere, but J&L wire rope (independent wire rope center, fiber core, SpringKore, PlastiKore) is nothing short of coiled POWER! It tackles tough jobs with amazing endurance. Precision engineered, it handles with easy assurance. Its plus values pay bigger dividends than blue chip stocks.

Try it! Make up your mind now to standardize on J&L wire rope for the pure satisfaction of owning a finer product.

FREE BOOKLET

Call any J&L number for your copy of WIRE ROPE IS A MACHINE, packed with practical information on selecting, handling, maintenance.

Jones & Laughlin

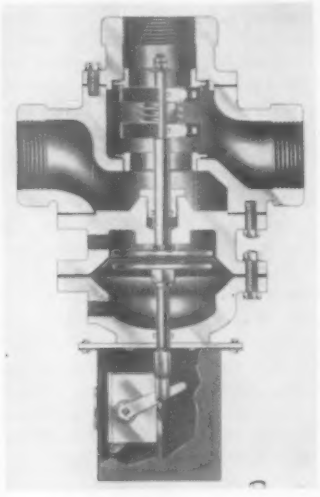
SUPPLY DIVISION – Tulsa

SERVING THE UNITED STATES AND CANADA

24-G

high strength, toughness, and chemical resistance. The gasket which seals the union joint, and which is in contact with the fluid in the pipe, is made of Teflon. **Write or call: W-S Fittings Div., H. K. Porter Co., Inc., P. O. Box 95, Roselle, N. J., for more information on insulating forged-steel unions.**

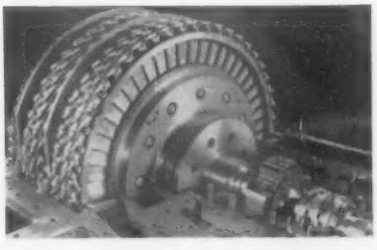
●



Three-Way Valve Assures Meter Accuracy

A three-way valve that eliminates slippage is now standard equipment on Rolocheck meters and metering separators. The valve is a neutral-position three-way valve that has disks which move with relation to the valve stem. The disks are separated by spring pressure. The open port closes before the other port opens. This action guards against the possibility of both valve ports being open at one time. Oil cannot bypass the meter; therefore meter accuracy is assured. **Write or call Rolo Mfg. Co., Box 6763, Houston, Tex.**

●



Axial Compressor Features Adjustable Stator Blades

Full stator-blade control on this new type of axial compressor extends the range of operating conditions for such a compressor with high efficiency, the maker reports. The compressor can be used with almost the same capacity variation as a centrifugal unit and still maintain the high efficiency and pressure rise at part-load points characteristic of axial compressors.

The machine is particularly adapted for large-volume applications where capacity variation is necessary in refineries and petrochemical plants. This is particularly so where large electric-motor drives are used and constant-speed operation is preferred to take advantage of the lower initial cost and more favorable operating characteristics of a synchronous motor, according to the manufacturer.

SHOWCASE . . .

New Equipment

On each row of stator blades, a hydraulic master positioner or an electric motor positions the blades. This arrangement allows each row of stator blades to be either adjusted separately or tied together to move at one time. **Write or call: Allis-Chalmers Mfg. Co., 1126 South Seventieth Street, Milwaukee 1, Wisc., for more information on the axial compressor with adjustable stator blades.**

PENN ENGINE SAFETY CONTROL acts to prevent costly loss!

Quick, protective action . . . that's what you get with a Penn Safety Control. Overheated cooling water or oil pressure failure can develop in the finest of engines. When this happens, serious damage will occur . . . but not if the engine is protected by a Penn Safety Control.

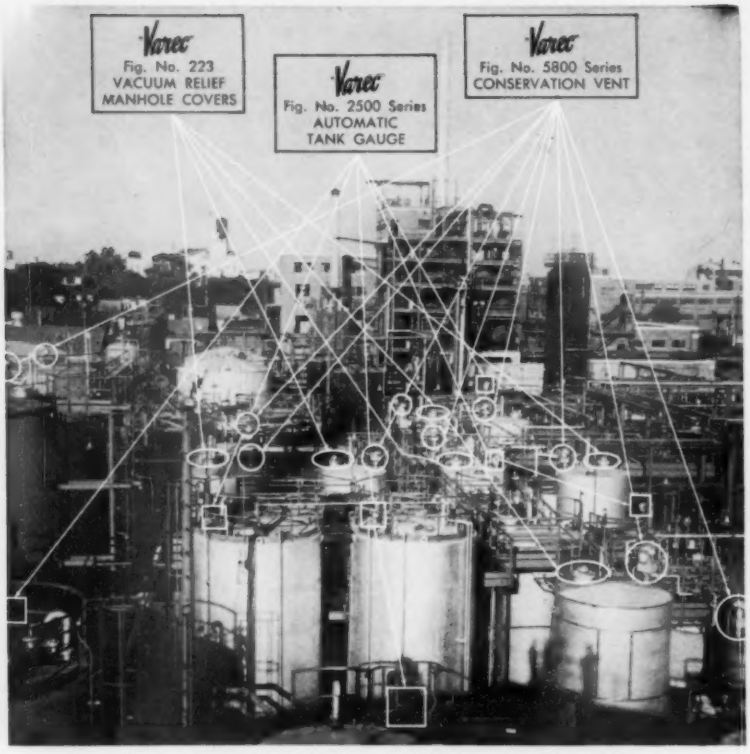
If water temperature rises beyond the safe point, or if oil pressure falls too low, the Penn Safety Control automatically sounds an alarm, flashes a warning light, or stops engine operation . . . whichever you choose. Then the cause can be investigated and the fault corrected before serious damage occurs.

ACT NOW . . . find out all about this low cost automatic protection for your new or old engines. Ask your Penn jobber today!

PENN CONTROLS, INC. Goshen, Indiana

EXPORT DIVISION: 27 E. 38th ST., NEW YORK, N.Y.

AUTOMATIC CONTROLS FOR HEATING, REFRIGERATION, AIR CONDITIONING, GAS APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES



Photo—Courtesy of Barrett Division—Allied Chemical and Dye Corporation

GOOD MANAGEMENT Recognizes the Value of GOOD TANK EQUIPMENT

A glance at the above photo of the Philadelphia plant of the Barrett Division of the Allied Chemical & Dye Corporation reveals dozens of storage tanks equipped with "Varec" Conservation Vent Units, Pressure and Vacuum Relief Manhole Covers, and Automatic Tank Gauges.

Here is practical evidence of the important role "Varec" storage tank equipment plays in the industrial scene. "Varec" Figure No. 5800 Series Conservation Vent Unit affords the greatest protection for venting inflammable liquid storage. Flame Arrester, Figure No. 50, is listed by Underwriters' Laboratories for use on oil storage tanks and approved by Associated Factory Mutual Laboratories for use on chemical storage.

"Varec" Figure No. 2500 Series, Automatic Tank Gauge, furnishes accurate liquid level gauging to plus or minus ⅛ inch. These gauges can be mounted with "Varec" PULSE CODE Transmitters to convert to a "Varec" PULSE CODE Telemetering System. This provides for remoting liquid level, temperature, motor valve or other equipment status, abnormal or alarm conditions and other data as required. Contactor units to supply "on - off" remote control of equipment such as pumps, motor-driven valves, etc., are available.

If your problem concerns the safety or control of your process, you can profit by sending for "Varec" P-7R Catalog.

"Varec"

THE VAPOR RECOVERY SYSTEMS COMPANY
2820 North Alameda Street
Compton, California

Cable Address:
Varec Compton California (U.S.A.) All Codes

961-19

SHOWCASE . . .

New Literature

American M.A.R.C. Diesel Engines. A new catalog gives data and specifications on low-horsepower, lightweight, air-cooled diesels. It contains information of interest covering small diesels in general. The 30-page, 2-color catalog includes installation data, profile drawings, performance curves, and lists of attachments and accessories. **Write or call American M.A.R.C., Inc., 1601 West Florence Avenue, Inglewood, Calif., for small-diesel catalog.**

●

Little Landis Pipe Threading and Cutting Machine is described in the eight-page Bulletin No. C-82-6. The machine has a ⅛ to 2-in. pipe range and is available as a stationary or portable model. It is designed for maintenance threading. Although primarily used for threading pipe, extra die-head-chase holders and additional die heads are available for bolt threading. **Write or call Landis Machine Co., Waynesboro, Pa., for Bulletin No. C-82-6.**

●

Chromatographic Equipment is presented along with other laboratory equipment in this 16-page, 2-color bulletin. It contains laboratory furniture and new laboratory apparatus including: (1) flask heater, (2) pocket-size pH meter, (3) continuous extractor for work with solvents heavier than water, (4) Auto-Stir for general laboratory stirring with speeds up to 1,200 r.p.m., and (5) Time-All timer which automatically turns appliances on or off. **Write or call Schaar & Co., 754 West Lexington Street, Chicago 7, Ill., for laboratory-equipment bulletin.**

●

Bendix G-15 General-Purpose Digital Computer is explained in this six-page bulletin. A new accessory, a digital differential analyzer, increases the range of operations of the G-15. Linear and nonlinear differential equations are solved accurately and rapidly with the two units. New programing techniques and a new line of input and output equipment are also described. **Write or call Bendix Computer Div., Bendix Aviation Corp., 5630 Arbor Vitae Street, Los Angeles 45, Calif., for the G-15 Computer folder.**

●

Fire-Resistant Compressor Lubricant. Pydraul AC is a fire and explosion-resistant fluid developed as a lubricant for air compressors. Technical Bulletin No. O-133 presents information on

typical properties, handling, and rate of use. Use of the fire-resistant fluid in place of petroleum oil reduces hazards of air-compressor explosions and receiver fires. **Write or call Monsanto Chemical Co., 1700 South Second Street, St. Louis 4, for Technical Bulletin No. O-133.**

●

Good-All Cathodic Protection Rectifiers are covered in this eight-page booklet. The rectifiers protect buried or submerged metallic structures from electrolytic corrosion. Such structures include: (1) pipelines, (2) telephone and power cables, (3) storage tanks, (4) well casings, (5) pilings, and (6) drilling rigs. The booklet covers design practice, selection, accessories, and includes photographs of the different models. **Write or call Good-All Electric Mfg. Co., Ogallala, Neb., for cathodic-protection rectifier booklet.**

●

Forged-Steel Gate and Needle Valves for petrochemical and other process plants are graphically described in 12-page Bulletin DH-80. The bulletin lists the valves' material specifications, pressure-temperature ratings, working pressures, dimensions, and applications. **Write or call: American Chain & Cable Co., Inc., 929 Connecticut Avenue, Bridgeport 2, Conn., for Bulletin DH-80.**

●

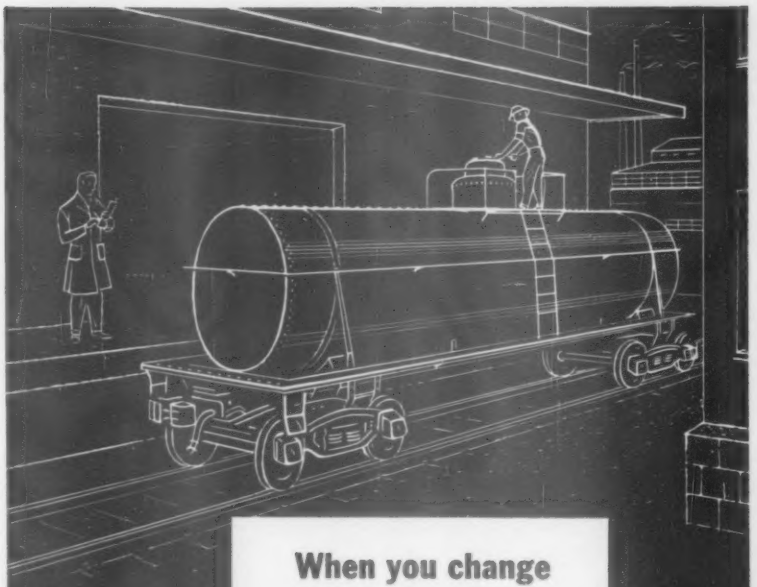
All-Electric Valve Actuator for proportional - position electronic - control systems is set forth in new Bulletin D-1. The control requires no intermediate operating fluids — either hydraulic or pneumatic. It can be mounted in any position and is lightweight and rugged, the bulletin states. The bulletin furnishes complete specifications, details the operating principles employed, and shows how the actuator fits into a control process. **Write or call: Conoflow Corp., 2100 Arch Street, Philadelphia 3, Pa., for Bulletin D-1.**

●

Kittell Silencer Catalog. A line of industrial, mobile, and marine silencers is described in the new 1957 catalog. It consists of 24 pages and provides dimensions, design principles, application photographs, and other data needed to specify silencers. **Write or call Kittell Muffler & Engineering Co., Inc., 915 South Santa Fe Avenue, Los Angeles 21, Calif., for silencer catalog.**

●

Combustion Controls and Instruments. This new informative catalog covers the requirements for a complete com-



When you change
raw materials...
consider the
FIRE HAZARD factor!

Perhaps the use of
a new type of raw material
can help you lower cost
or increase sales.
But if that material
is a flammable liquid,
be sure your program
for fire protection
meets your new requirements.
Ask National Foam
for helpful recommendations!

NATIONAL FOAM System, Inc.
West Chester, Pa.

NATIONAL FOAM FIRE PROTECTION SYSTEM

The only company exclusively engaged in the design, development and manufacture of foam fire protection equipment and chemicals.

bustion installation. It includes: (1) automatic draft-control instruments and actuators; (2) solenoid, diaphragm, and motor-operated valves for oil, gas, steam, and water; (3) time switches; (4) relays, and (5) oil-burner primary controls. **Write or call: General Controls Co., 801 Allen Avenue, Glendale 1, Calif., for catalog, Combustion Controls and Instruments.**

●

Arc-Welding-Machine Catalog. The equipment of interest in new Catalog 1340 includes selenium-rectifier and d.c. motor generator arc welders for industrial welding, a.c. and d.c. engine-driven arc welders for construction and maintenance, and a.c.-transformer arc welders for plant and shop use. The catalog lists the specifications for each machine, including ampere ratings and outside dimensions. **Write or call: Air Reduction Co., Inc., 150 East 42nd Street, New York 17, N. Y., for Catalog 1340, Form ADC 7O8C.**

●

Stainless Steel with increased chromium and nickel content over stainless steel Types 302 and 304 are presented in this new booklet. The eight-page booklet furnishes detailed information on Types 308, 309, and 310 stainless steel. It includes such information as physical properties, heat treatment, strength at elevated temperatures, fatigue strength, and resistance to oxidation. The steels can be used in furnace parts, boiler baffles, fire-box sheets, still-tube supports, and pump parts. **Write or call: Advertising Dept., Allegheny Ludlum Steel Corp., 2020 Oliver Building, Pittsburgh 22, Pa., for the publication, Stainless Steels, Types 308, 309, and 310.**

●

Power Trap described in two-page Bulletin 501 is designed with magnetic, pneumatic, and automatic action to: (1) free air and gas lines of entrainments, (2) assist air and gas dehydrating equipment, and (3) discharge condensate in compressed air and gas lines. In the bulletin, a schematic diagram shows how the trap operates, the text describes maintenance procedures, and a table lists the trap's specifications. **Write or call: Hankison Corp., 951 Banksville Road, Pittsburgh 16, Pa., for Bulletin 501.**

●

Combustion Analyzer described in four-page Product Specification Sheet 65-5 indicates the per cent by volume of oxygen and combustibles present in the exhaust gas from all types of boiler and other industrial furnaces. The sheet provides operating and physical characteristics for the analyzer together with a list of accessories and helpful ordering information. **Write or call: Bailey Meter Co., 1050 Ivanhoe Road, Cleveland, Ohio, for Product Specification E65-5.**

●

Reciprocating Compressor Bulletin DS-361 contains ratings and data on Trane's 125 and 150-hp. compressors and condensing units. In the new bulletin, ratings on 60, 75, and 100-ton condensers have been revised to conform with a new and more efficient condenser which incorporates water heads at both ends to make condenser tubes easier to clean. **Write or call: Trane Co., La Crosse, Wis., for Bulletin DS-361.**

●

Inclined Remote-Reading Gages. Data Unit 291 supplement (two pages) illustrates and describes the new Jerguson Truscale remote-reading gages, available with an indicating scale inclined up for clear visibility in applications where gages have to be mounted low on an instrument panel or inclined down for high installations. **Write or call: Jerguson Gage & Valve Co., 80 Adams Street, Burlington, Mass., for Data Unit 291.**

SAVE VALUABLE FIELD TIME WITH ENARDO CLOCKS
Save time and trips by installing an Enardo Clock Shut-Off Valve.
You can soon pay the initial cost of installing the Enardo Clock by saving the return trips necessary to check installations.
The Model "W" Clock is designed to control the flow of low pressure gas or liquid and to shut off the supply at a predetermined time, with a positive bottle tight seal. Valve will function at operating pressures up to 100 p.s.i.
The Enardo "MB" and "A" time cycle switches are designed to control electrical circuits on pumping engines and other equipment. They will shut-down the engine at any number of hours, up to 22 hrs. on the 24 hr. model; and 11 hrs. on the 12 hr. model. All clocks are manually wound and set.
Always look to Enardo for the finest in oil field equipment.
"A" & MB Type Time Cycle Switch
"W" Clock Shut-Off Valve
ENARDO
manufacturing co.
BOX 1647 • TULSA, OKLAHOMA

ACCURACY
FLEXIBILITY
CONTROL

WITH HALLIBURTON PROPORTIONERS

At every rate of fluid injection up to 70 barrels of fluid per minute, and for every size fracturing job up to the largest ever performed, Halliburton Sand-Fluid Proportioning Equipment gives you accurate, variable control of the sand-fluid ratio going into your producing formation.

For the only method that combines this wide range of injection rates with the extreme accuracy, flexibility, and constant control of sand-fluid ratio so important to successful fracturing, call your local office or write Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

Auxiliary equipment—storage tanks, agitating mixers, stabilizers—are arranged in sequence with Halliburton's sand-fluid Proportioners and booster pumps. The prepared fracturing mix is furnished to Halliburton's safer, diesel-powered high pressure pumps in a continuous operation that has produced millions of dollars' worth of additional oil for thousands of well owners.

HALLIBURTON

OIL WELL CEMENTING COMPANY

Ask for bulletin: Elements of Hydraulic Fracturing

PIONEERS IN FRACTURING SERVICES

251 SERVICE CENTERS — JUST MINUTES AWAY FROM ANY RIG

EQUIPMENT MEN . . . in the News

Continental-Emsco Names Alexander Department Head

ALEXANDER

Organization of a complete sales-promotion department by Continental-Emsco Co., a division of Youngstown Sheet & Tube Co., and appointment of William J. Alexander as manager has been announced by Frank I. Brinegar, executive vice president in charge of distribution. The new department will coordinate all sales-promotion, advertising, and public-relations activities of Continental-Emsco.

Alexander was formerly advertising manager of Emsco Manufacturing Co. in Los Angeles until that company and Continental Supply Co. merged to form Continental-Emsco with headquarters in Dallas, and plants in Houston and Garland, Tex., and Los Angeles.

Cardwell Holds Sales Meeting

Cardwell's sales personnel and district managers who attended a recent 3-day meeting in Wichita, Kans., to discuss a newly established program of sales and service are shown here. The meeting was keynoted by Paul Courtney, general manager of the company.

Front row, left to right: Rodney Freeman, district manager, Houston; Van A. Nelson, district manager, Midland, Tex.; W. E. Volkman, New York, export manager; Paul Courtney; J. T. Tucker, general manager of sales, Houston; Earl Moyer, district manager, Oklahoma City; Len Downing, district manager, Denver; Charles Spitzfaden, assistant sales manager, Wichita, Kans.

Back row, left to right: Clyde Lackey, district manager, Mount Vernon, Ill.; Grothe Poe, Wichita; Maurice Canfield, Wichita; Srecko Kajfez, European representative; Frank Bell, Corpus Christi, Tex.; Jules Haltenberger, South American representative; John Campbell, Houston; W. C. Phillips, Midland, Tex.; A. F. Schroeder, advertising manager; Bill Hicks, district manager, Duncan, Okla. Arthur Harvey, sales manager (not pictured) was in South America on a sales trip at the time of the meeting.

Hammond Makes R. E. Kramer Executive Vice President

R. E. KRAMER

The appointment of Ralph E. Kramer as executive vice president in charge of general operations and sales has been announced by Robert Y. Kopf, president of Hammond Iron Works Co. Kramer will devote his time between Warren, Pa., New York, and the various plant offices of the company.

Kramer, who has been vice president in charge of sales for Hammond the past 12 years, for many years prior to his association with Hammond was engaged in manufacturing and marketing heavy machinery and tools for the oil, mining, and construction industries.

Phillips Represents Warner Lewis in Eastern States

Milton A. Phillips has been appointed as Warner Lewis Co.'s representative for eastern United States.

Phillips, prior to his new assignment, served as an assistant sales manager with the company in Tulsa. As eastern representative, he will supervise activities of the company representatives in Pennsylvania, New York, and Middle Atlantic and New England states.

Pfaudler Names Holcombe As New York City Manager

Dewey R. Holcombe has been named district sales manager of New York City area for Pfaudler Co. of Rochester, N. Y. He has sold for Pfaudler since 1946. He moved to the New York sales force in 1956.

Delta Tank Advances Gasal To Be Vice President

R. A. GASAL

Appointment of Russell A. Gasal as vice president of Delta Tank Manufacturing Co., Inc., has been announced by Joe E. Ketner, executive vice president and general manager. Gasal has served as general manager of Delta's midwestern tank-fabricating plant in Beardstown, Ill., since 1955 and will continue to direct operations there.

Prior to joining Delta 2 years ago, Gasal served in executive positions with Butler Manufacturing Co. of Kansas City, Mo. He earlier was with Skelly Oil Co.

Bogle to Head Wire Rope Section for J & L Supply

C. E. BOGLE

A new wire-rope section has been incorporated into the sales organization of Jones & Laughlin Supply Division at its Tulsa headquarters office. The appointment of C. E. Bogle to the newly created position of manager, wire-rope section, was announced by W. L. Wolfe, vice president of sales.

Bogle formerly was in charge of wire-rope sales in the Rocky Mountain area for Jones & Laughlin Steel Corp. In his new assignment, he will concentrate on the promotion of wire-rope sales through the firm's field sales force and will report to W. O. Hardy, sales manager of general products.

Leschen Makes Mann Head Of Wire Rope Division

Emmett H. Mann has been named vice president and general manager, Leschen Wire Rope Division, H. K. Porter Co., Inc. Until his present appointment he held a similar post with the Alloy Metal Wire Division.

At the same time, announcement was

This is the better, easier way to pump oil wells...

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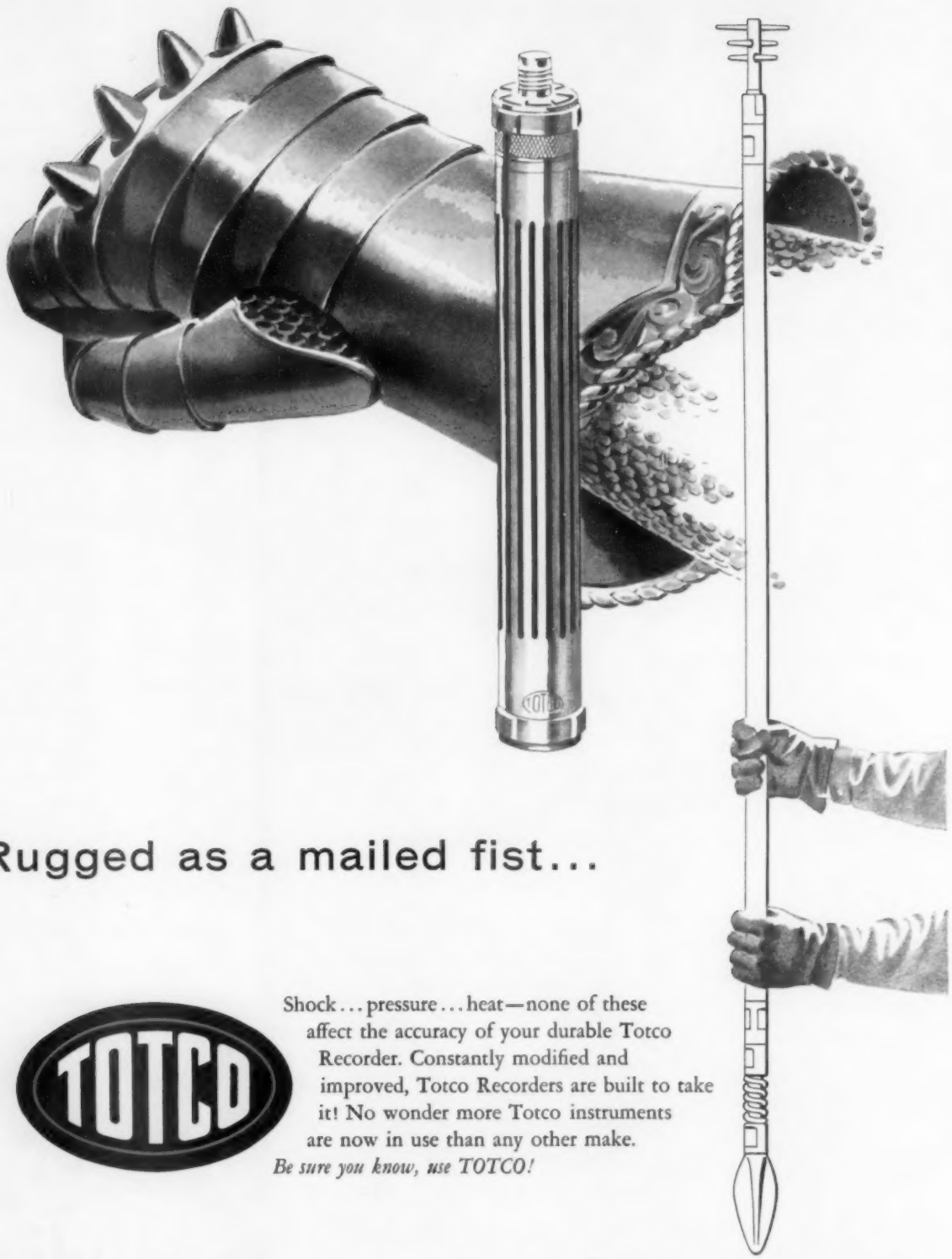

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made of an expansion program at Leschen which will be completed toward the end of this year. Leschen will have its own wiredrawing equipment to integrate the production of wire rope. Delivery will be accelerated and greater plant flexibility will be achieved.

Mann joined Alloy 7 years ago as a sales engineer, became its sales manager, and in 1956 its general manager.

Schlumberger Announces Ten New Assignments

Ten personnel promotions and new assignments have been announced by Schlumberger Well Surveying Corp.

R. T. WADE

C. F. GRICE

R. T. Wade has been named technical assistant to the vice president of field operations. The new manager of the Tyler, Tex., district is C. F. Grice.

W. H. THROOP

BILL FRY

W. H. Throop is transferred from Corsicana, Tex., to Monroe, La., where he assumes the position of location manager. Bill H. Fry has been named manager of the Snyder, Tex., district.

J. E. Ramsay has been promoted to senior sales engineer at Corpus Christi, and G. F. Horst assumes the same position for the Permian Basin division at Midland. R. C. Barber is now senior sales engineer at Wichita, Kans.

New sales engineers for Schlumberger are V. A. Hertling, Mount Carmel, Ill.; A. F. Stewart at Flora, Ill.; M. R. Curtis at Fort Morgan, Colo.

Wade joined Schlumberger in 1934. He has served in Corpus Christi, Midland, and Tyler, Tex.; Ventura, Coalinga, and Long Beach, Calif.; and Winfield and Shreveport, La.

Grice joined Schlumberger in 1950 and has been manager of the Monroe, La., district. Prior to his new assignment, Fry served as manager of the Monroe, La., district and as sales engineer at Midland.

Davis to Manage New Dowell Sales Office in Denver

E. H. DAVIS

Dowell Incorporated opened a general sales office in Denver February 1, according to R. S. Ousterhout, service sales manager. Increasing activity in the Rocky Mountain, western Canada area and the desire to provide better customer service and sales coverage make the new office an important addition to Dowell's sales organization, Ousterhout said.

E. H. Nielsen, formerly manager of Dowell's Denver district, will head the new office as general sales engineer. Nielsen has been succeeded by Earl H. Davis as manager of Dowell's Denver district.

Nielsen joined Dowell in 1944. In 1950 he was transferred to the company's general sales office in Tulsa where he remained until he moved to Denver in 1952. A year later he became manager of the Denver district, a position he held until his recent transfer. Nielsen's territory will include the Rocky Mountain states and western Canada.

Davis joined Dowell at Great Bend, Kans., in 1948. He was transferred to the company's general office sales department in Tulsa at the same time Nielsen went to Tulsa. In 1953 Davis became area manager in Dowell's Salem, Ill., district. Since 1955 Davis has been in Tulsa as assistant to the general manager of the company.

Caterpillar Reveals Plans For Industrial Engine Plant

Plans to build a 500,000-sq.-ft. industrial engine plant have been announced by H. S. Eberhard, president of Caterpillar Tractor Co. The Peoria firm also announced its intention to construct a multibuilding research center and a general office building. All three facilities will be located on an 1,100-acre site.

Site preparation for the industrial engine plant is scheduled to begin within the next few months and construction dates for the research center and general office building will be established after planning and necessary engineering work have been completed. Operations will begin during 1958 and 1959 in the new area.

The new plant will be the source of manufacture for V-type engines ranging up to 650 maximum horsepower in the current line. The source for all other engines will continue to be the Peoria plant. Basic engines intended for industrial use will be moved to the industrial engine plant where attachments, specially engineered to equip them for use as industrial and torque converter power units, marine engines or electric sets, will be added.

Lufkin Sales People Hold Conference

The annual sales conference of the oil-field division of Lufkin Foundry & Machine Co. was held in January with these representatives attending:

Front row (seated), left to right: E. P. Trout; C. D. Richards, assistant sales manager; Guy Croom; M. L. Wilkinson; W. W. Troust; L. A. Little, oil-field division sales manager; A. E. Cudlipp; W. A. Kirkland; J. B. Hopper; and D. A. Reid.

Second row, left to right: F. C. Hays, G. L. Vickrey, A. G. Black, Milton Kramer, B. C. Burnette, Carl Frazer, Gene Tate, Lloyd Athey, Frank Stevenson, Ben Sargent, W. T. Crowder, R. E. Barr, Elvin Read, Vernon Glenn, Robert Spaulding, T. D. Lashly.

Third row, left to right: G. W. Nichols; A. E. Caraway; C. E. Dyer; J. L. Dake; J. D. Mettauer; Oliver McKay; Jack Jumper; R. L. Poland; Hubert Dyer; Marion Hightower; R. S. Miller; A. L. Christina; Jack Gissler.

Fourth row, left to right: Glenn Henderson, T. L. Bowers; Louis Fincher; H. H. Muller; Jim Brown; Joe Randol; Bob Dunlop; Henry Burnett; L. W. Breeden; Ben Elliott; Dan Martin; Gene Nixon; George Henson; Howard Hogue; W. H. Miner; Herman Maberry; Robert Gibbs; Newell Lynch; E. A. Stanfield; Val Gallia; R. L. Rhodes; William Corey.

Back row, left to right: John Cluck; Warren Johnson; Von Smith; Ernest Slaughter; T. A. Banta; Carrol Watts; John Swanson; Tayloy Hood; Jim Roe; Roy Lilley; Don Bowcutt; R. C. Thompson, and Fred Griffin.

Metal to Metal Wear...

is the real villain in sucker rod pump troubles. It accounts for most of your repair and pump pulling expense.

The Martin Idea...

for getting away from this trouble has always been to make use of the best available materials — *Natural Rubber* for the key material in plunger rings; *Synthetic Rubber* for the key material in resilient ball guides for cages.

The accurately grooved and drilled metal body of **The Martin Plunger** does not touch the barrel. Only the resilient rubber and duck rings contact the barrel. This material — with its great natural resistance to abrasion as well as its slipperyness-when-wet — has a much slower wearing action on the barrel. Most often your barrel will not need replacing. These rings have an amazing ability to take the kind of abuse that goes with oil well pumping, and this means longer runs. Plunger cost is reduced because replacing the rings costs only about one fourth as much as a new plunger, and this saving is, of course, added to the barrel saving and longer runs.

Patent No. 2,591,174

The Martin Rubber Guide Cage protects the ball from all metal contact except when it rests upon its seat. The ball is protected to such an extent that ball and seat life is usually doubled. The synthetic ball guide and stop cannot beat out because of its resilience. Its life is therefore much greater than any metal and you get this longer cage life in addition to better ball and seat life. The two guides are easily replaced when the occasion does arise.

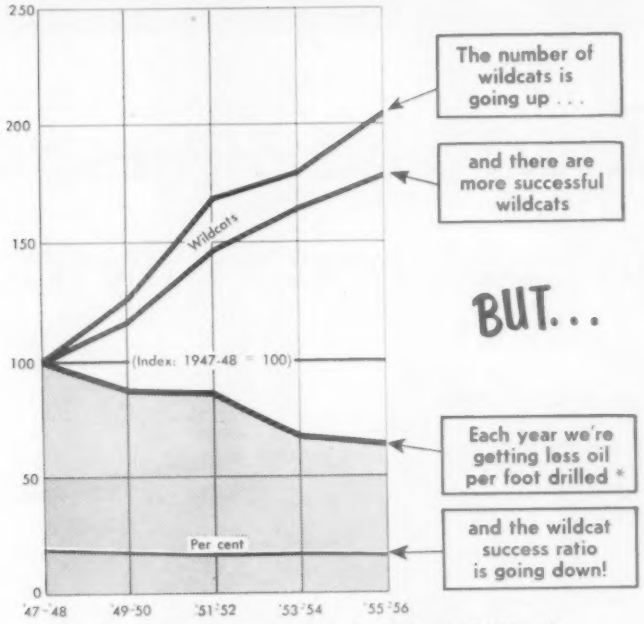
No real capital outlay is required to get these benefits because the cost of Martin Plungers and Martin Cages is very much the same as you are now spending for replacements — sometimes less.

All regular or stroke-thru ROD PUMPS and TUBING PUMPS can be equipped with Martin Plungers. Martin Rubber Guide Cages are made in all sizes and styles. Write for our catalog No. 4; also see Composite catalog for 1956-57.

JOHN N. MARTIN

Manufacturer

9 W. BRADY • TULSA, OKLA.



*These figures include all exploratory and field wells. Reserves include crude oil, natural-gas liquids, and natural gas converted to crude equivalent.

Even better than words, this chart shows why . . .

Multibillion-Dollar Gamble Faces Long Odds

by Norman S. Morrisey

"WHAT are the trends in exploration?" The answer to this question is of prime importance to oil companies, because they have earmarked a 3.6-billion-dollar budget for exploration and production during 1957. There is little doubt that oil is harder to find each year. But this statement has been true for the past 30 years.

Nationwide, the exploratory success ratio (see figure) has been fairly constant during the past 10 years, although there is a definite downward trend. But roughly one out of every six exploratory tests is successful in the United States. This figure, it must be remembered, includes **all** exploratory tests; the odds in rank wildcatting are considerably worse. Yet the United States drills twice as many exploratory tests today as it did in 1947.

This is the first in a series of articles on the results of exploration. The first covers the United States. Later articles will analyze the important producing areas of the country. And in the Journal's Exploration Number, April 1, there will appear the final article in this series, answering the question, "Where Is Exploration Most Successful?"

During the peak postwar years in exploratory and field drilling, the average successful oil well proved up 168,200 bbl. of new reserves. This includes both exploratory and field wells. Today the average successful oil well finds only 120,000 bbl.

And the amount of new reserves per foot of hole drilled is declining. During 1947-48, each foot of hole drilled in the United States found 44 bbl. of new reserves; this figure is based upon total footage and reserves include crude oil, natural-gas liquids, and natural gas converted to barrels of crude oil. In 1955-56, each foot of hole proved up 29 bbl.

Finding and development costs per barrel are approaching the $2 mark (see Chase Manhattan Bank's recent report, "Investment Patterns in the World Petroleum Industry"). Finding costs are continuing to mount. The trend is toward deeper drilling to find new reserves.

One major oil company reports that the average cost of its wildcats has nearly doubled in the last 5 years.

New thinking . . . How can exploration prove most successful when costs are rising and new reserves per well are declining? There are several possible solutions that are open to oil finders.

- Strat traps are coming into the forefront in exploration circles because of their large reserves. In the past, many of these were stumbled on by luck; East Texas is a classic example. Today, geological thinking is pin-pointing areas where large strat traps may occur. And the drill is confirming the geological idea with new oil reserves.

- Better completion techniques have added a considerable amount of new oil during the past 5 years. At last count, 20 per cent of all oil wells in the United States had been fractured. The number is increasing at the rate of 5,000 wells per month.

- New areas will give up oil. One year ago the oil reserves of the Paradox basin in southeastern Utah were insignificant. Drilling activity in 1955 gave little indication of what was to happen in 1956. Today the Paradox basin is the hottest oil province in the country. Estimates of proved and semi-proved reserves range from a conservative 250 million barrels for the Aneth trend to over 500 million barrels. A 500-well development program is forecast for the next 24 months.

The gratifying part about oil exploration is that there are many more undeveloped basins in the country comparable to the Paradox. In spite of the rising costs of finding oil, the industry is gambling on finding these spots. Will oil finding prove successful in 1957? The oil industry is betting 3.6 billion dollars that the answer is "Yes." **End.**

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IN REED TOOL JOINTS, YOU MAY SELECT...

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Many factors are important in tool joint selection—whether your rig is readily accessible or isolated, the hole size and depths to be run, the chemical properties of formations and drilling fluids, services to be performed and tools to be used, hydraulic facilities, and even crew experience. You must decide which tool joints to use under your specific drilling conditions.

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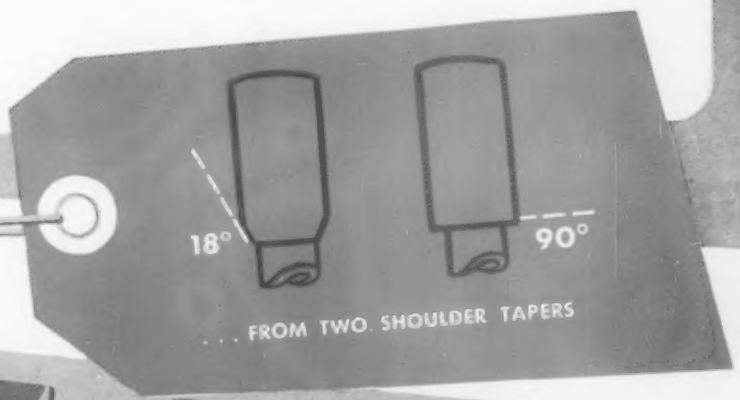
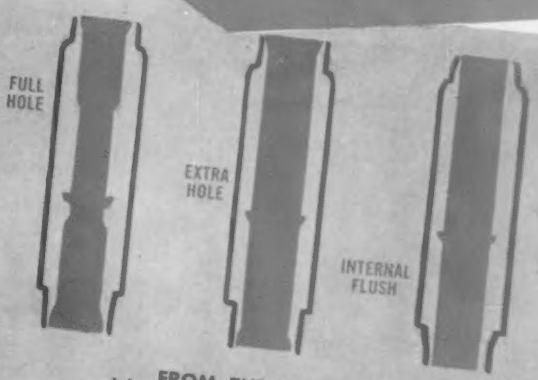
Write or wire for complete information . . . or have your Reed man explain the economical

Does Reed make a Super Shrink-Grip tool joint with 18° shoulders?

every type and combination quality... the very best!



. . . FROM TWO SHOULDER TAPERS



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. . . WITH OR WITHOUT INARCLAD† HARD METAL APPLICATION

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in tool joint design.

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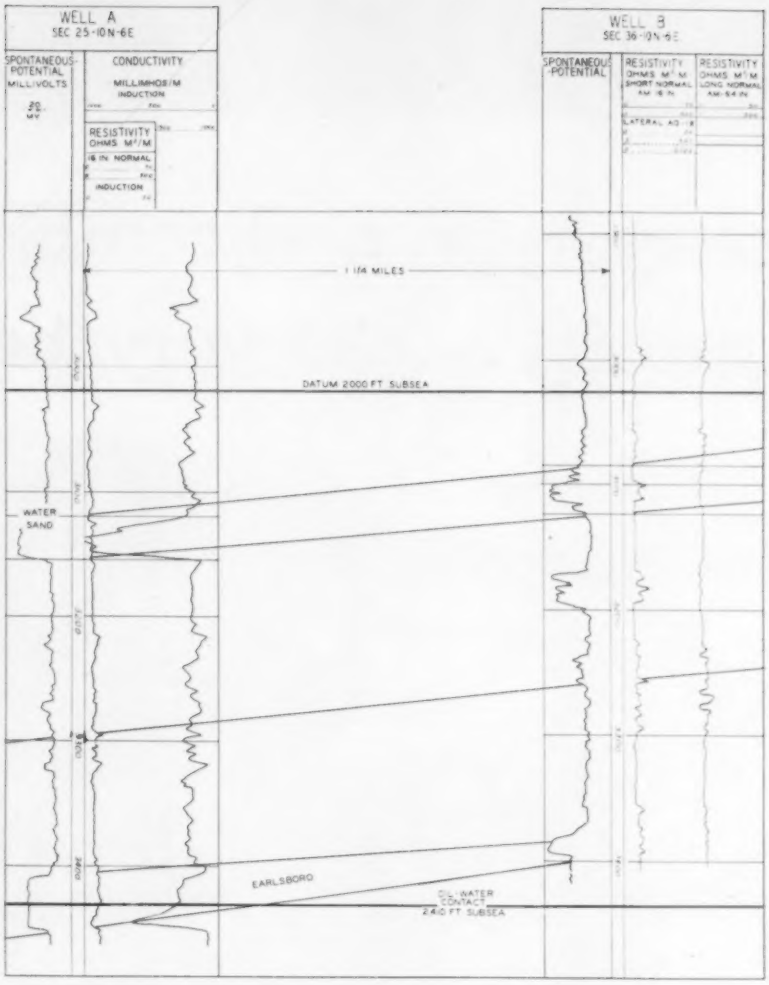
† Increased production facilities now permit Reed to offer Inarclad on all three—Flash Welded, Super Shrink-Grip, and Counterbore Weld tool joints!



OIL-WATER CONTACT in the Earlsboro sandstone is spotted easily on the conductivity curve of Well A. Notice the low resistivity in the sand in Well B. Fig. 1.

New Logging Technique

by Norman S. Morrisey
Drilling-Development Editor

OKLAHOMA operators are leaning heavily on the new combination induction-electrical log to evaluate the oil possibilities of both shallow and deep pay zones.

Induction logs give accurate and detailed information in formations of low and medium resistivities. Under favorable conditions, the curve shows the oil-water contact accurately as well as the formation boundaries. Beds as thin as 5 or 6 ft. are mapped in detail. It is particularly useful in determining the oil possibilities of both porous sands and thin porous zones within highly resistive sands or limestones.

Keokuk area . . . The Earlsboro sand in the Keokuk area is a good example of a productive sand of low resistivity. On the conventional electric logs there would be a definite tendency to pass up this zone (Well B, Fig. 1). However, a study of the induction log (Well A) shows immediately the productive possibility of the sand.

Well B in Fig. 1 is a conventional electric log from a well that was completed making 360 bbl. per day after fracture treatment. In Well A it is fairly easy to spot the oil-water contact at 3,430 ft. (2,410 ft. subsea.) The operator set pipe and completed this well through perforated interval 3,414-26 ft. for 360 bbl. per day.

Since Well B is updip from Well A, operators anticipate that there will be a fairly large producing area from the Earlsboro in Section 25 and 36-10n-6e.

After pipe was set in Well A, operator tested two zones below the oil-water contact indicated on the induction log. Zone 3,440-52 ft. yielded 2 bbl. of oil and 3 bbl. of salt water on a 4-hour swab test. Zone 3,434-46 tested 34 bbl. of oil and 35 bbl. of salt water on an 8-hour test. These zones were squeezed off and the well was finally completed above the oil-water contact.

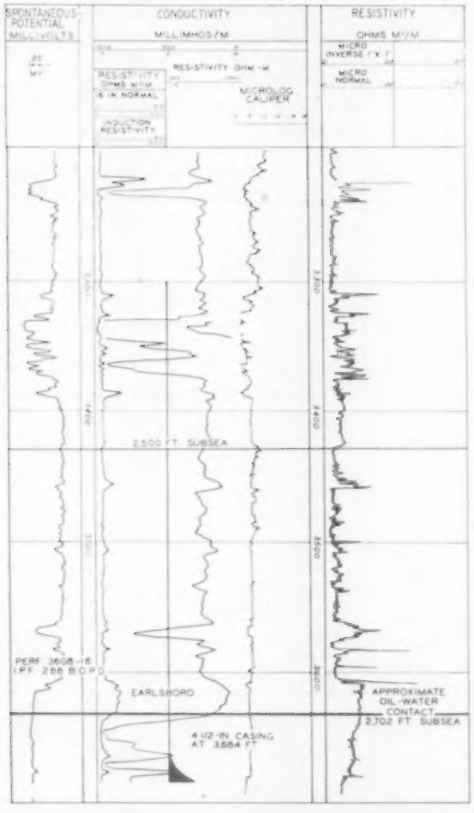
North Remus area . . . Trend Petroleum Co. recently completed an interesting Earlsboro test in the North Remus area (see Fig. 2). The operator tested the middle Earlsboro sand interval 3,610-25 ft. while drilling. On drill-stem test, the zone flowed oil, but when the tester was pulled, the recovery included 30 ft. of salt water.

The oil-water contact is clearly apparent on the induction log (Fig. 2) at approximately 2,702 ft. subsea. Operator set pipe and completed the well through perforations above this contact for an initial potential of 288 bbl. per day with no water.

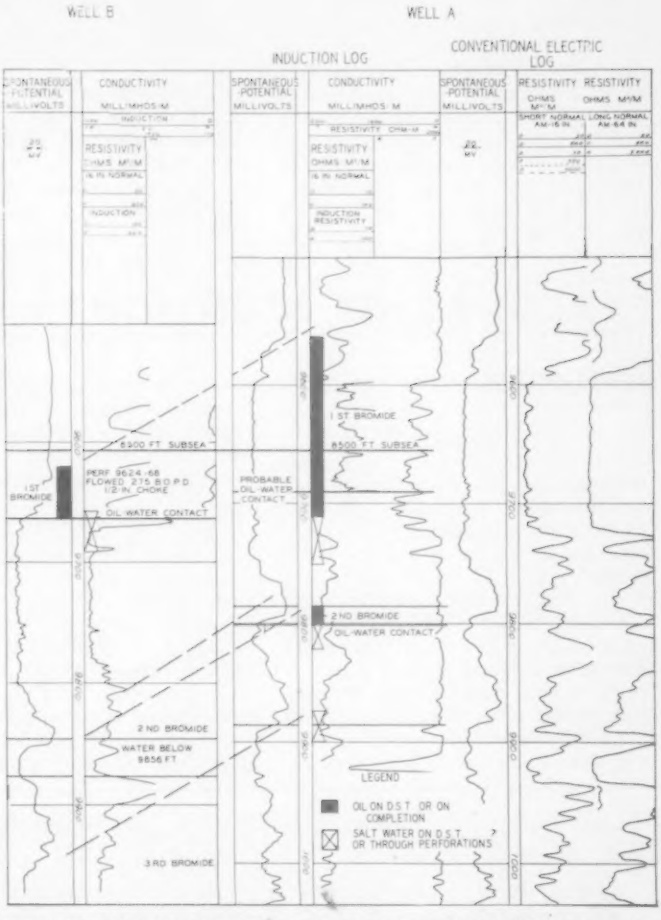
Simpson section . . . The induction log has proved particularly useful in evaluating Simpson sands in some of the recent deep tests in McClain County. In several of these sands, minerals are present that cause abnormally low resistivity values. These minerals make it exceptionally difficult to evaluate the oil-bearing zones if conventional electric logs are used. Small variations in resistivities are readily detected with the conductivity curve of the induction log.

Well A was recently completed as a discovery well with production from two zones in the Bromide (Fig. 3) and also from the Bois d'Arc section of the Hunton. The Hunton section is not shown in Fig. 3. Analysis of the induction log of Well A shows production possibilities from 9,569 to 9,692 ft.

A cursory examination of the conventional electric log of this interval would probably condemn this zone, particularly below 9,595 ft. The oil-water contact based on the induction log analysis is picked at 9,692 ft., where there is a definite increase in conductivity in the porous first Bromide sand indicating salt water.



EARLSBORO SAND produces in North Remus field. Here the oil-water contact picked on the induction log was confirmed by drill-stem tests. Fig. 2.



THE SIMPSON SAND SECTION at Northeast Payne field is difficult to analyze because of the low resistivities. Here the induction-log analyses are in excellent agreement with drill-stem tests. Fig. 2.

Spots Oklahoma Oil

Similarly in the second Bromide or Tulip Creek sand (interval 9,792-9,848 ft.), the oil-water contact can be easily picked at 9,804 ft.

Actual drill-stem tests taken during drilling of the well confirm the interpretations. Drill-stem tests and the induction log serve to condemn the Simpson sands below the second Bromide or Tulip Creek.

In Well A the oil-water contact in the first Bromide was established at a subsea datum of 8,541 ft. by the induction log; drill-stem tests place the contact between 8,559-8,561 ft. subsea.

The 40-acre offset to this discovery (Well B, Fig. 3) established the oil-water contact between 8,552 and 8,590 ft. subsea by drill-stem tests. Analysis of the induction log of Well B places the contact at 8,563 ft. subsea (plus or minus 10 ft.) Both wells are in the same reservoir because the oil-water contact in each well is found at approximately the same depth subsea.

Drill-stem tests and induction log analyses on both Wells A and B are in remarkable agreement.

Oil-water contacts in this area are of particular value in defining the reservoir limits and delineating faults. Production apparently is controlled by faulting, although few wells ever actually cut the faults. More often than not, a high dry hole is the only clue to the presence of the faults, but the faults are clearly apparent when oil-water contacts in the different reservoirs are compared.

How the induction log is used . . . Actually the new combination induction-electrical log includes the spontaneous potential (S.P.), at 16-in. short normal curve and an induction curve expressed in terms of conductivity and resistivity. The S.P. and short normal curves provide lithologic correlations, aid in identifying permeable beds, and supply important log analysis factors. The induction resistivity and conductivity curves determine and evaluate the possible productive zones.

The induction-electrical log measures values close to true formation resistivity without the distortion of the multiple electrode spacings used in standard electrical logging. The method works best in resistive muds, i.e., fresh-water or oil-base. It clearly detects conductive salt-water sands even behind a resistive invaded zone.

Service companies recommend running a MicroLog in addition to the induction-electrical log. The MicroLog will confirm the existence of porous and permeable zones that may produce and in addition is invaluable for quantitative studies.

Briefly, the induction log measures the conductivity of a bed. The conduc-

tivity is the ability of a formation to pass electric current and mathematically is the reciprocal of the resistivity. This means that there is not a direct linear relationship between resistivity and conductivity scales. This, however, is not a serious problem, because electronically, the conductivity values measured by the induction log are converted to a linear resistivity scale on the electric log.

Summary

The induction-electrical log is easy to interpret because:

1. It has greater resolution in thin beds.

2. It has excellent investigation properties.

3. It is less affected by hole size.

3. Less affected by adjacent beds.

5. Clearly shows oil-water contacts.

EXPLORATION HIGHLIGHTS

APPALACHIAN

OHIO

Natol Corp.'s 1 E. O'Hail (Logan Kline), Section 17, Knox Township, Holmes County, is making 50 bbl. daily from fractured Clinton at 3,154-3,205 ft. The producer is the second oil well in what first appeared to be a gas pool.

- Pure Oil Co. 1 M. E. Dunfee, Lot 15, Licking Township, Muskingum County, a southeast extension to the Nashport pool, gaged 98 bbl. in a 24-hour test after fracturing Clinton sand at 3,178-3,222 ft.
- Ohio Fuel's first offset to the discovery on Shaver, Section 12, Clay Township, Muskingum County, the 1 Edward Smith, Section 14, gaged 600,000 cu. ft. natural and is to be fractured before completion.

PENNSYLVANIA

In Mount Pleasant Township, Westmoreland County, Southwest Pennsylvania, Keta Oil & Gas Co. 1 Victor Schworer, rank wildcat, elevation 1,570 ft., was dry, Tully 7,120 ft., Onondaga 7,800 ft., chert 7,837 ft., water 7,837 ft. Total depth 7,838 ft. Efforts to bail off and control the water were unsuccessful and the hole is being plugged and abandoned.

WEST VIRGINIA

Licking district, Tucker County, West Virginia, Hope Natural Gas Co. 10009 Thaddeus Pritt, wildcat, elevation 1,812 ft., shut down at a depth of 4,626 ft., to fracture. The Oriskany sand was at 4,420 ft., gas 4,464-69 ft. Helderberg 4,523 ft., gas 4,553 ft. The initial gas shows tested 1,917,000 cu. ft., and blew down to 1,782,000 cu. ft.

- Williamsburg district, Greenbrier County, Columbian Carbon Co. 1235 Pattie Beavers is drilling at 3,457 ft.

EASTERN KENTUCKY

United Fuel Gas Co. at their wildcat 28 Fordson Coal Co. are drilling below

Exploration This Week

Appalachian	220
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Kansas	226
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Otis Side-Door Tools

Otis... "First in Pressure Control"

Type S

Otis Side-Door Tools are now available in "S" dimensions... The new, standardized series for Otis "selective" landing nipples.

OTIS SIDE-DOOR CHOKE

OTIS SEPARATION TOOL

1,700 ft. Test is located on Left Fork of Elkhorn Creek in Leslie County and northeast of the town of Sizerock. This is a projected Cambro-Ordovician test and will be the first such test for the county.

CALIFORNIA

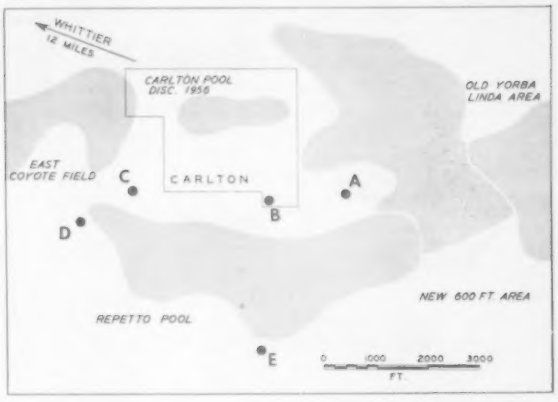
Yorba Linda Productive Limits Stepped Out

Extensioners completed at Yorba Linda field, 25 miles east of Los Angeles, assured it will remain the most active in the basin during coming months. Successful outposts were added in the low-gravity 600-ft. area as well as to the 2,300-2,700-ft. Repetto pool south of the town of Carlton.

Five step outs completed, or being completed at the time of writing, are shown on the accompanying map.

A—W. E. Burnett 1 Day was having pumping equipment installed after testing about 50 bbl. daily, with a combination string set at 2,079 ft.

B—Mid-Continent Oil Co. 1A Saulsbery was being hydrafracted after drilling to 2,753 ft. and then redrilling to 2,450 ft.



New extensions in Yorba Linda field, 25 miles east of Los Angeles, promise that this will be the busiest area in the basin in the coming months.

C—Drilling & Exploration Co. 1 Nay-Tamme was being completed at a depth of 2,450 ft.

D—Christopher Oil Co. 1 White pumped 98 bbl. of 16°-gravity crude upon completion, through perforations at 2,454-82 ft.

E—Truck Finance Co. 1 Nittel was completed pumping 108 bbl. of 17°-gravity crude, through perforations at 2,187-2,243 ft.

These were among the recent wells in the Yorba Linda area, which has been undergoing a drilling revival for the past 3 years. More than 50 new wells have been added in the 150-acre pool east of the old area. About 60 have been completed in the 200-acre Repetto pool, also discovered in 1954. The Carlton pool, opened last August, is likewise of Repetto age but structurally it may be related with the East Coyote field.

Current output of the Yorba Linda pools is 3,800 bbl. daily, as compared with less than 500 bbl. daily in early 1954. About 10 rigs are working in the area.

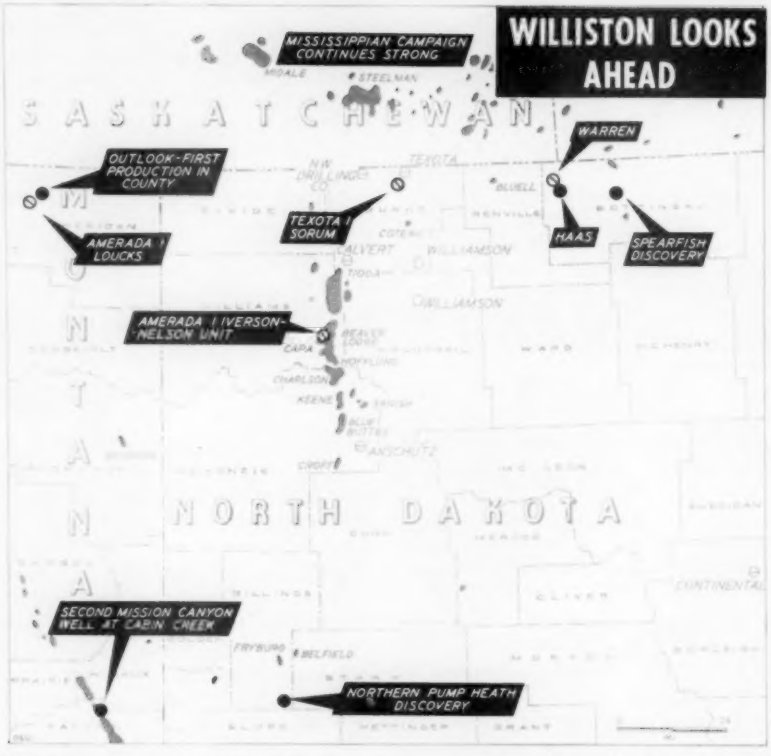
for Dual Completions

More than 20 two-zone completion and production operations are possible with Otis Removable Side-Door Chokes, Otis Separation Tools, and related Otis Side-Door Equipment. These Otis sub-surface controls provide a simple and economical method of completing and producing two zones through the same well bore without commingling the fluids. Dual completions allow the economical production of so-called "stray" oil and gas formations which normally would not be feasible nor practicable to produce. If you are about to complete or re-complete a well in a multiple-pay area, talk to your nearest Otis office about installing side-door equipment. They will be glad to give you illustrated literature and complete details without obligation.

OTIS PRESSURE CONTROL, INC.

BRANCHES THROUGHOUT THE OIL COUNTRY

PRESSURE CONTROL OTIS SERVICE - EQUIPMENT



Williston exploration in 1957 will likely uncover some startling discoveries. Late 1956 and first 6 weeks of 1957 was most important discovery period since Beaver Lodge in the basin.

Two Big Strikes Ignite Williston Basin Drilling

by John C. McCaslin
District Editor

WITH its most significant discovery year since Beaver Lodge behind it, the Williston basin is geared for what promises to be another banner exploratory session. Within the past 6 weeks the basin has seen two of the most important and prolific strikes in its drilling history — Outlook and Fritz. Amerada Petroleum Corp.'s Outlook Silurian discovery in Sheridan County, Montana, and Northern Pump Co.'s 1 Fritz, a Heath sand strike in Billings County, North Dakota, have fanned a new spark of wildcat enthusiasm throughout the basin.

Here is the Williston scoreboard to February 1:

The Discoveries

- **Amerada 1 Tange,** C NE SE 20-36n-53e, Sheridan County, Montana. IPF 2,742 bbl. of oil per day, Silurian at 9,056-74 ft.
- **Northern Pump Co. 1 Fritz,** SE SE 15-137n-100w, Billings County, North Dakota. IPF 1,224 bbl. of oil per day, Heath sand 8,055-72 ft.
- **Leach Oil Co. 1 Smith,** SW SW 14-162n-80w, Bottineau County, North Dakota. IPP 90 bbl. of oil, 21 hours, lower Spearfish-Triassic 3,425-33 ft.
- **Texota Oil Co. 1 Sorum,** C SE SE 23-163n-91w. IPP 138 bbl. of oil, 14 hours, Nesson-Mississippian 5,846-56 ft.
- **Shell Oil Co. M-21-33 Unit,** Cabin Creek field, Fallon County, Montana. IPF 226 bbl. of oil per day, Mission Canyon producer, second such well in field.

The Activity

- North Dakota has 31 active drilling operations—nine of them wildcats.
- Montana's portion of the basin has 22 active locations, three of them wildcats.

Discovery Impact

At Outlook . . . Amerada's big discovery at Outlook is the most significant hit in the Montana portion of the Williston basin since Poplar.

. . . Outlook field is the first production in Sheridan County.

. . . Nearest production is 29 miles southwest at Northeast Bredette field, Daniels County.

. . . The discovery well was drilled in the center of vast untouched acreage.

. . . Closest Silurian production is 92 miles southwest at Southwest Richey. There is no Silurian oil in North Dakota, although the Beaver Lodge discovery well had flowing oil from that formation.

. . . Outlook's success should stir wildcatting a few miles north across the Canadian border.

At Fritz . . . Northern Pump Co.'s 1 Fritz, Heath sand discovery in Billings County, will certainly be one of the highlights of exploration in North Dakota for 1957.

This Heath-Upper Mississippian well is the best Heath producer to date in Williston.

Nearest Heath sand production is 12½ miles north at Fryburg field.

The Fritz discovery will likely stir up some wildcat drilling in Stark, Slope, Billings, and possibly some other southwestern North Dakota counties this year.

And now?

The hour is yet a bit early to foresee what the rest of 1957 will unfold in Williston exploration. One thing is certain—the huge province will see increased wildcatting in all corners.

. . . In Montana. The confirmation well to Amerada's Outlook discovery is drilling. There will be other wildcats probing this northeastern corner of Montana this year.

. . . In North Dakota. Look for increased activity once again on the northeast side of the basin in eastern counties. Some of Saskatchewan's Mississippian cornucopia should lop over the border.

The explorers are closely watching Amerada's deep wildcat at Beaver Lodge on the Nesson anticline. This deep one is down below 13,610 ft. in the Winnipeg-Ordovician. Oil and gas flowed from several formations on the way down—the biggest flow being from the Silurian below 11,000 ft. There is a definite trend in Williston toward new-pay exploration, both in Montana and North Dakota. Expect some pre-Mississippian tests popping up in widespread places throughout the basis this year.

CANADA

ALBERTA

Viking Is New Pay In Whitecourt Region

The Whitecourt area of Alberta, where the three company team of Canadian Fina Oil, Ltd., Pan American Petroleum Corp. (formerly Stanolind Oil & Gas Co.) and Hudson's Bay Oil & Gas Co., Ltd., is carrying out an extensive exploration and development project, has now yielded free oil from the Viking sand formation and thus added that zone as a potential producing horizon in this extremely interesting area. As well as this new strike, a well which was reported in this column as having fully penetrated its gas-pay sector in the D3 formation and being drilled in this area by the same team ran further tests lower in that formation and indicated that such was not the case as gas flows of 14,700 and 12,800 M.c.f. daily have been recorded. The report in last week's column stated that the water line had been reached as a recovery of salty sulfurous water was present in the drill pipe upon completion of a drill-stem test. That was reported in error from the wellsite and should have read slightly sulfurous water and subsequent testing up to 95 ft. below the formation top has proved a full gas-bearing zone.

The Viking oil discovery well, Fina-Pan American-H.B. 7-5 Windfall, lies on the eastern side of the team's large reservation block which includes approximately 1,100,000 acres and is 2 miles west of a previously completed D3 zone of Devonian wet-gas well. Other wells in this area have indicated gas production from the Viking, and have also showed oil staining in core recoveries from that zone but no free oil was previously recovered on drill-stem tests. The Viking sand has been penetrated and crew is now drilling ahead.

Turning now to the D3 gas strike, H.B.-Pan American-Fina 1 Pine Creek, on LSD 2, 10-58-19w5, in the center of the block of acreage. The discovery zone was contacted at 11,317 ft. and latest test reported was bottomed at 11,412 ft. which indicated a prolific gas bearing section so far tapped and further test operations are being carried out to fully evaluate the reef in this sector.

East Kaybob Discovery Completed

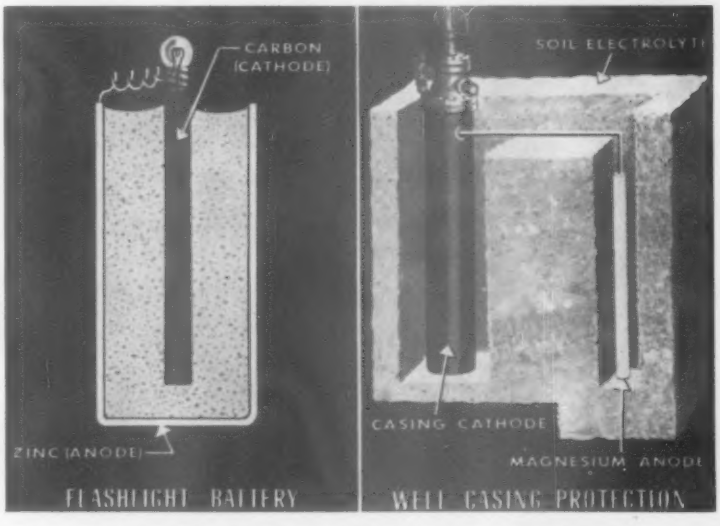
The Hudson's Bay Oil & Gas Co., Ltd.-Union Oil Co. of California team which discovered gas in two zones during straddle packer test operations in January at its East Kaybob well, on LSD 6, 20-61-18w5, has completed that well as a potential Viking sand gas well. Drill-stem test in this section indicated a gas flow rate of 1,250,000 cu. ft. daily with an 11-ft. net pay zone while production test operations run from an 18-ft. perforated sector in the Viking flowed gas at maximum rate, 3,500 M.c.f. per day.

This success lies 50 miles north of Edson townsite and 22 miles northwest of the Wildfall Viking sand oil discovery well reported previously. It is on Petroleum and Natural Gas Reservation No. 1992, a 92,160 acre tract which is held jointly by the two firms.

The other gas bearing zone, the basal Cretaceous, gave up that product at maximum rate of 1,500 M.c.f. daily during drill-stem tests but was not evaluated for production by the team.

Virginia Hills Appears To Be Major Discovery

Home Oil Co., Ltd.'s 9-20 Virginia Hills wildcat oil discovery well which was reported unofficially last week, appears to be a major discovery as a second test also gave up oil and it has been estimated that the pay sector, not definitely known but thought to be



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either lower Beaverhill Lake or the so-called Middle Devonian-Slave Point formation, is at least 65 ft. thick. This well is being drilled by Home, United Oils, Ltd., Alminex, Ltd., and Geoil, Ltd., on farmout acreage acquired from the team of Hudson's Bay Oil & Gas Co., Ltd., and Union Oil of California.

This important strike lies on LSD 9, 20-65-13w5, 125 miles northwest of Edmonton and 25 miles southwest of another well in the area being drilled by the same group, but on acreage acquired from Regent Refining (Canada), Ltd.

Initial drill-stem in the zone was reported as having recovered 5,000 ft. of clean oil (40° API) and as well gave a gas flow estimated at maximum to be 300,000 cu. ft. daily; while second test also gave a gas flow and pipe recovery consisted of 2,400 ft. of gassy mud and oil emulsion (estimated to 50 per cent oil).

This well is the first of two pre-Cambrian tests which Home and its associates will drill on this acreage spread. Upon completion of the two wells the group will have earned a one-third interest in the lands with the remaining interest shared jointly by the H.B.-Union team.

The engine to consider for medium-deep wells

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UNITED STATES STEEL

SASKATCHEWAN

Discovery Assured West of Weyburn

Canadian Oil Companies, Ltd., has been assured of oil success at a 1½ mile west step-out to the main producing section of the Weyburn oil field in southeastern Saskatchewan, 11 miles south-southeast of Weyburn town. This new success, White Rose-Security Freehold 16-25 Weyburn, on LSD 16, 25-6-14w2, is the first venture completed by the company in 1957. Charles zone drill-stem test yielded a pipe recovery of 1,170 ft. of gassy oil, to assure backers of another producer.

Last year the company had an exceptionally high success ratio on wildcats drilled, registering one success out of each three drilled. This compared with the industry average of one of nine.

ILLINOIS BASIN

ILLINOIS

Two New Oil Pools in Illinois in January

Two new oil pools were discovered in Illinois in January, according to the Division of the Department of Registration and Education. One of the new pools, Clifford, is in Williamson County about 7 miles from the nearest production. The discovery well is the second producing well completed in Williamson County. The first was an Aux Vases sandstone well near Marion which produced only a few hundred barrels of oil. The Clifford discovery well produces from the Aux Vases, Rosiclare and McClosky. Initial production was 20 bbl. of oil and 18 of water. The second new pool was Tamaroa South in Perry County producing from the Cypress sandstone.

There were five new extensions to pools: Whittington West and Dale Consolidated in Franklin County, Iuka in Marion County, Barnhill in Wayne County, and Maunie North Consolidated in White County.

The rate of drilling in the state has slowed down after about 3 years of steadily increasing activity. In January only 216 wells were completed, in comparison with 315 for January 1956. The 216 completions include 104 oil wells. There is no outstanding area of development. Over 28 per cent of the wells completed in January 1957 were wildcats. New areas opened up in 1955 and 1956 are becoming drilled up and development drilling is widely

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Illinois oil production for January is estimated at 7,260,000 bbl.

KANSAS

SEDGWICK BASIN

Wichita Offset Well Flows Oil on Test

The north offset try to new Wichita oil field at the north edge of Kansas' largest city flowed oil on a drill-stem test of the Viola lime.

O. A. Sutton et al 1 Strickland, SE SE SW 34-26s-1e, 1 mile northeast of the new field, recovered 3,338 ft. of free oil on a test at 3,313-38 ft. in the Viola. There is a dry hole between this well and the field proper.

SOUTHERN KANSAS

Simpson Strike Due at Runnymede Gas Field

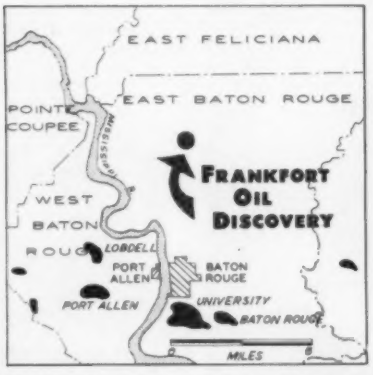
Northern Harper County's Runnymede gas field, a one-well producer, added a Simpson oil well. The Texas Co. 1 Litsey Unit, NE NW NW 25-31s-6w, ½-mile southeast stepout to the gas field well, flowed 133 bbl. of oil in 4 hours plus 2,652 M.c.f. of gas per day on ⅜-in. choke. Perforations are in the Simpson at 4,642-50 ft. Natural flow was 73 bbl. of oil in 2½ hours and 3,000 M.c.f. of gas daily on 1-in. choke. The operator is now waiting on state potential.

LOUISIANA

SOUTH LOUISIANA

Frankfort Opens Field in East Baton Rouge Parish

Frankfort Oil Co. is opening another deep oil-producive area in East Baton Rouge Parish. Its discovery well, 1 Decker, in 71-5s-1w, is 6 miles north of Baton Rouge. Nearest production is in the University field, at the southeast edge of Baton Rouge, and Lobdell field, about the same distance southwest, across the Mississippi River, in West Baton Rouge Parish.



Location (indicated on map) of Frankfort Oil Co.'s new oil-discovery in northern East Baton Rouge Parish.

The well flowed at an estimated rate of 150 bbl. of oil per day on initial tests through ⅛-in. choke. Flow was under pressure of 300 psi. Gravity of the oil is 33°.

Production is from Frio sand, perforated at 10,104-10 ft. Total depth is 12,100 ft. University field is productive from multiple sands ranging in depth from 4,300 ft., in Miocene, to below 9,900 ft., in Frio.

New Gas Discovery Splits Orange Grove-Gibson Gap

C. G. Glasscock and Tidelands Oil Co. report completion of their deep wildcat test 3 miles northwest of Orange Grove field, 10 miles west of Houma, in Terrebonne Parish, as a gas producer.

The well, 1-B Continent Land & Fur Co., in 50-17s-15e, is rated good for 2,640,000 cu. ft. of gas daily, flowing through ⅝-in. choke. Liquid (48.5°-gravity, clear condensate) recovery at

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that rate of flow is 10.10 bbl. per day. Flowing pressure is 4,325 psi.

Hole was drilled for 12,043 ft. Productive interval is 10,718-22 ft.

Location is about midway between Orange and Gibson fields.

Gas-Condensate Producer Extends North Elton Area

The North Elton area, in southeastern Allen Parish, got a ¾-mile southwest extension with an 8,200-ft. gas-condensate producer completed last week by Bel Oil Corp.

Bel's well, 1 Goodrich, flowed 18 bbl. of 61°-gravity condensate with 942,000 cu. ft. of gas per day during its completion gage through 5/32-in. choke. Flowing pressure was 2,100 psi.

Productive interval, in the Frio-Homeseekers "B" sand, is 8,197,-8,200 ft. Hole was drilled to 8,690 ft.

North Elton field, 2 miles north of Elton, was opened in 1939. More than 20 productive wells have been completed with sands ranging in depth from 6,000 to below 8,200 ft. Production is gas and condensate.

Erath Outpost Produces

Productive area of the large Erath field in eastern Vermilion Parish continues to spread. Latest extension is on the southeast side, where Phillips Petroleum Co. has a new outpost producer testing 135 bbl. of 31.7°-gravity oil per day through ¼-in. choke. Flowing pressure gages 320 psi. on the tubing side with gas-oil ratio of 371 cu. ft. per bbl. Its Miocene pay is perforated at 7,025-43 ft. Bottom is 7,120 ft.

MICHIGAN

Clean Oil Flows At Allegan Discovery

Reacidized in Traverse lime oil pay with 3,000 gal. Ford Henry and Jack Hobson 1 Cook, SE SW SE 6-3n-11w, Wayland Township wildcat, Allegan County, flowed as much as 156 bbl. of clean, net oil in 16 hours. Next two 24-hour gages were 108 bbl. and 100 bbl. Well was being restricted to 50 bbl. daily, pumping and flowing an average of 8 to 9 hours each day, to hold well head casing pressure at 150 to 160 psi.

This new shallow district discovery, first one to appear to be of major importance in several years, logged top of Traverse lime at 1,694 ft. Pay showed at various points between 1,696 ft. and 1,712 ft., total depth.

Located about 1 mile north and west of the original Wayland Traverse oil pool, new wildcat discovery, on basis of these early tests, appears to be a stronger, more prolific producer than anything drilled in the older pool. Henry & Hobson have an acreage block of approximately 4,000 acres surrounding this wildcat which extends beyond Wayland Township into both Leighton and Hopkins Townships, Allegan County.

Well carried about 250 ft. of free oil natural from Traverse pay in 40 hours. After a 500-gal. clean up acid treatment, the 1 Cook was swabbed and tested during hole clean-out for about 2 weeks, during which time it produced approximately 290 bbl. of net oil. Through February 6, including production following acid treatments, 750 bbl. of oil had been sold from this well.

Several deals were in progress with other developers for possible farm-out of close-in leases but no new locations had been announced at time of this report.

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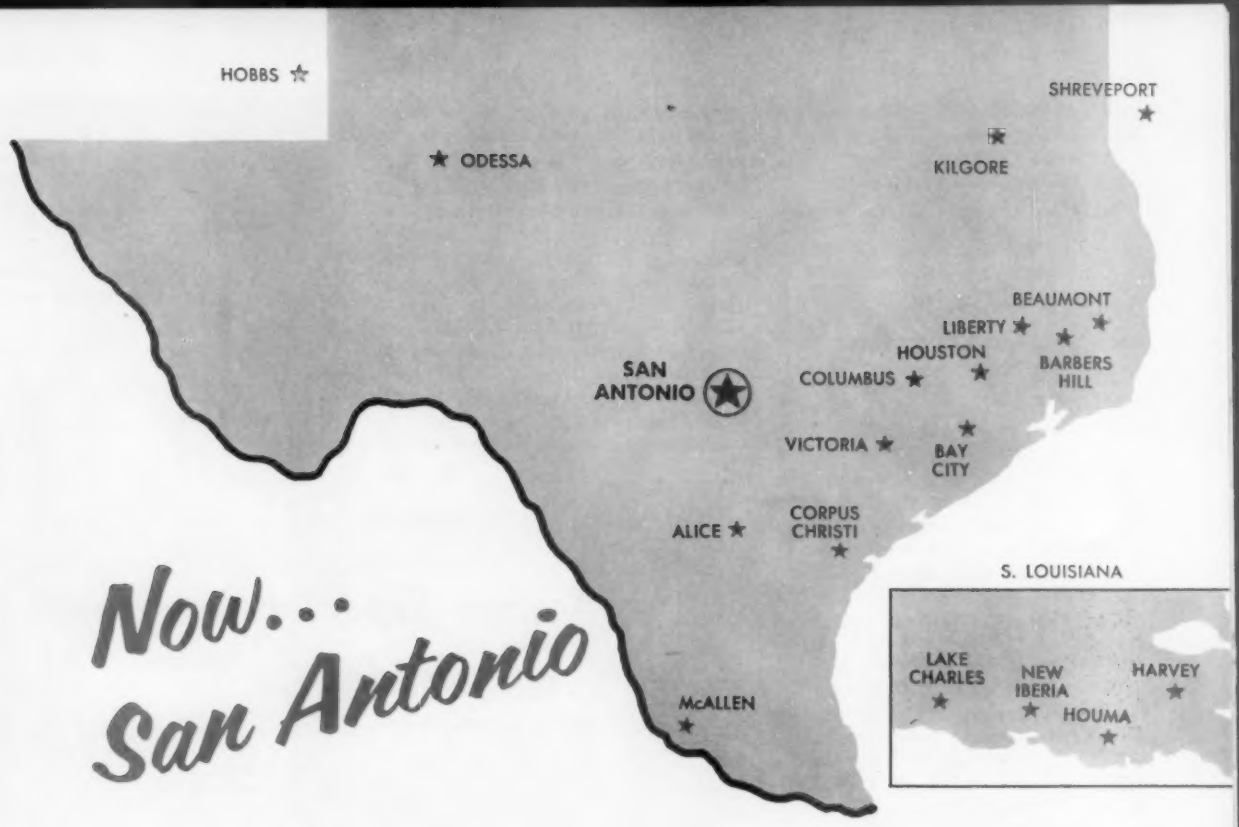

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OKLAHOMA

ONCE again in 1957 Oklahoma's exploratory and development interest centers in southern and south-central counties—Cleveland, McClain, Grady, Stephens, and Love. The big objectives in this campaign are:

- The Hunton (Siluro-Devonian) in McClain County.
- The Ordovician sands in Cleveland, Stephens, Grady, McClain, and Love counties.
- The shallow Lone Grove sand (Deese-Pennsylvanian) in Love County's Overbrook area.

The deep push . . . The trend in drilling in southern and South Central Oklahoma is fast leaning to the deep. The Pennsylvanian sand search that was so well known in this area is giving way to the Simpson (Ordovician) hunt, particularly on the northwest flank of the Pauls Valley uplift.

. . . In Cleveland County. Deep discoveries in the Ordovician sands near Noble, south of Norman, are becoming the drilling order of the day in this area.

A 500,000-bbl. per well Bromide and Tulip Creek sand oil reservoir was tapped early this year at Anderson-Prichard Oil Corp. 1 Allison in 27-8n-2w near Noble. The discovery well produced 199 bbl. of oil in 14 hours from the Tulip Creek sand at 8,210-15 ft.; 300 bbl. in 19 hours from the Bromide sand at 7,900-05 ft.

. . . A confirmation well, the 1 Bucheit, NE NW SW 27-8n-2w, flowed 20 bbl. of oil per hour from the Bromide sand at 7,904-11 ft.

In the same area Oil Capitol Corp. opened another Bromide sand pool at 1 Allen in SE SE NE 32-8n-1w. This discovery well flowed 160 bbl. of oil in 31 hours on test through 6/64-in. choke from perforations in the upper part of the Bromide sand at 7,470-71 ft.

Another busy Cleveland County producing area is the Moore district. Lone Star Producing Co. has production from two pays at its 2 Nail in C SW NW 14-19n-3w, Northeast Moore field. This is the thirteenth well in the field. Pay is from the Bartlesville sand (lower Pennsylvanian) at 7,470-80 ft. and the Hunton lime at 7,560-78 ft. The well flowed 96 bbl. of oil in 15 hours on ¼-in. choke from the Bartlesville; 159 bbl. in 15 hours from the Hunton on 20/64-in. choke.

Rapid development drilling of these new Cleveland County producing areas is expected.

. . . In McClain County. Focal point of an intensified and rewarding deep Simpson-Ordovician sand search in South Central Oklahoma is Northeast Payne. This fast-growing pool is on a newly discovered fault trend north of the Golden Trend where eight new fields have been tapped in the past 2 years.

Goff-Leeper Drilling Co. opened Northeast Payne pool at 1 Little in NW SE 4-5n-3w. The flowing discovery well had pay in three sands—Hunton, Bromide, and Tulip Creek. Two other Bromide wells have been added to the field.

. . . North Payne. Just 1 mile west of Northeast Payne activity, Weimer & Fitzhugh and Pyramid Oil Co. 1 Hanley Unit, NE SE NW 5-5n-3w, was recently completed as the second well in North Payne pool, another Hunton and Bromide reservoir. The well flowed 20 bbl. of oil per hour from the Hunton at 9,055-85 ft.; 16 bbl. per hour from the Bromide sand at 10,240-45 ft.

The discovery well at North Payne was the 1 Hanley, SW NE 5-5n-3w. It flowed 480 bbl. of oil per day from the Hunton and 780 bbl. per day from the first Bromide sand.

Early in February, Sunray-Mid-Continent Oil Co. opened still another field southeast of Northeast Payne at 1 Manning, SE NW SW 10-5n-3w. This discovery flowed 147 bbl. of oil on

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¼-in. choke from perforations in the Hunton lime at 8,278-8,312 ft.

Cleveland and McClain counties' new Ordovician and Hunton success further emphasize the growing potential of these rocks as prolific oil reservoirs in southern and South Central Oklahoma. The new deep trend developing in this area will be busy for some time to come.

... In Grady County. A fifth location has been staked on the deep Knox structure in Grady County by British-American Oil Producing Co. The latest addition is in 28-3n-5w. All five wells are planned to the below-15,000-ft. mark. It is at Knox that British-American established Oklahoma's deepest producing-depth record last year at 2 Harrison. This well was a prolific gas-condensate producer at 15,310 ft. in the Ordovician sands.

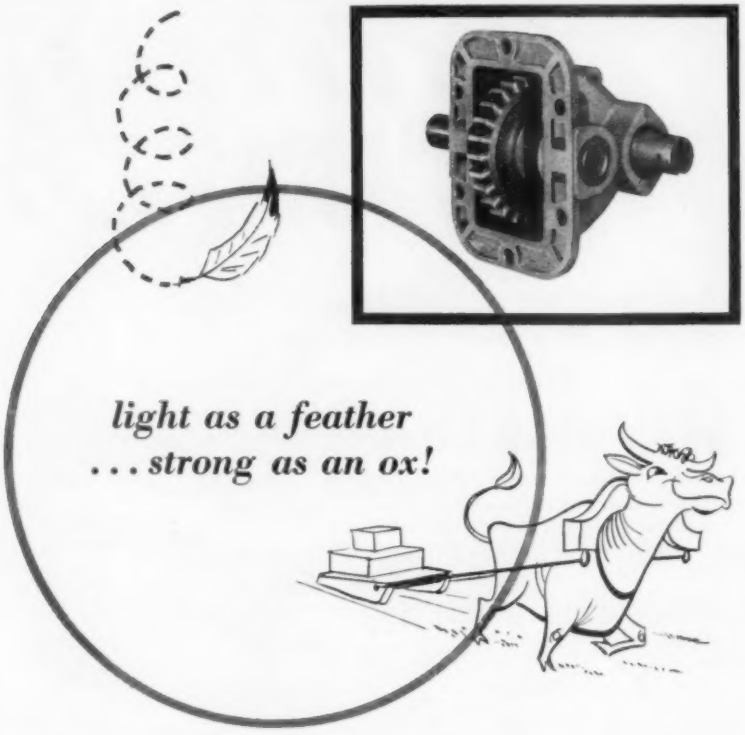
... In Stevens County. The Texas Co. and Mercury Drilling Co. added to Ordovician excitement in southern Oklahoma at 2 Prichard in the Velma district, SE SW SW 4-2s-4w. This well flowed 213 bbl. of oil in 14 hours on a small choke from perforations in the Oil Creek sand at 8,944-79 ft.

... In Love County. An indicated Oil Creek sand discovery east of Marietta in extreme southern Oklahoma promises an active development program. The Texas Co. et al 1 Westheimer in NW SW NW 17-7s-3e, tested more than 9,000 M.c.f. of gas and 200 bbl. of condensate per day from the Oil Creek sand at 8,785 ft. Tentative locations for the new area are reported.

The shallow push . . . An important shallow-well development program is in gear in the Overbrook area of Love County.

A narrow 2-mile producing trend between Ardmore and Greenville fields is shaping up fast. Sanders, Continental Oil Co., Dunlap, Merrick, and other operators are developing this new producing trend with production in the Lone Grove sand (Deese - Pennsylvanian) above 2,000 ft. The trend extends southeast from 12-6s-1e into 18-6s-2e.

One of the best recent additions to this area is Continental Oil Co. 1 Jefferson in SW NE NE 12-6s-1e. The well flowed 110 bbl. of oil per day from the upper Deese at 908-74 ft., and 286 bbl. of oil per day from the lower Deese at 1,206-64 ft.



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TULSA, OKLAHOMA DIVISION OF VICKERS Inc.

SOUTH-CENTRAL OKLAHOMA

Bucheit Well Is Success In Noble Townsite

Anderson - Prichard Oil Corp. 1 Bucheit, NE NW SW 27-8n-2w, Noble townsite discovery area well, recovered 6,200 ft. of oil on a drill-stem test at 8,202-07 ft. in the Tulip Creek sand-Ordivician. A test at 8,187-97 ft. made 26 bbl. of oil per hour. The Bromide sand was the discovery pay in this new field.

East Noble area . . . The booming Ordovician play in this area continued at a fast clip last week with completion of another discovery well, southeast of here. Oil Capitol Corp. 1 Allen, SE SE NE 32-8n-1w, flowed 204 bbl. of oil per day, natural, on 10/64-in. choke from perforations in the Oil Creek sand at 7,470-71 ft.

Fourth Well Added to Northeast Payne Field

Sunray-Mid-Continent Oil Co. 1 Little, C SW SE 4-5n-3w, is the fourth producer in new Northeast Payne field, McClain County.

The well flowed 24 bbl. of oil per hour for 6 hours on 20/64-in. choke from perforations in the first Bromide sand at 9,596-9,620 ft. Another test made 10 bbl. per hour for 12 hours on 14/64-in. choke.

Hunton discovery . . . About 1 mile southeast of Northeast Payne field, Sunray 1 Manning, SE NW SW 10-5n-3w, found Hunton lime production to open a new field. The well flowed 147 bbl. of oil in 10 hours on ¼-in. choke from perforations in the Hunton lime at 8,278-8,313 ft. The Bromide at 9,254-59 ft. had only water.

Second Hunton Well Finaled at Northeast Moore

Northeast Moore pool in Cleveland County has another Hunton lime producer. The new addition is An-Son Petroleum and Hershey Oil Co. 2 Turner, C NW NE 14-10n-3w.

The well flowed 360 bbl. of oil per day on 18/64-in. choke from perforations at 7,492-7,502 ft.

NORTHWEST OKLAHOMA

Laverne Report

Two dual producers were completed in the Laverne district of Harper County.

. . . Sun Oil Co. 1 Love, C SE NW 18-26n-24w, flowed 2,740 M.c.f. of gas per day on ¾-in. choke from perforations in the Chester-Mississippian at 7,064-7,116 ft.; from the Hoover-Pennsylvanian it flowed 2,630 M.c.f. per day on 24/64-in. choke.

. . . Sun 1 Boyd Unit, C NW SE 19-26n-24w, flowed 1,020 M.c.f. per day on 24/64-in. choke from Hoover perforations at 4,298-4,340 ft.; 2,310 M.c.f. per day on ¾-in. choke from the Chester at 7,142-78 ft.

WEST CENTRAL OKLAHOMA

East Columbia Adds Dual Penn Producer

A dual producer has been added to Kingfisher County's East Columbia field. The new well is Tennessee Gas Transmission Co. 1 Channel, NE SW NE 25-18n-5w.

The well flowed 213 bbl. of oil in 24 hours on 14/64-in. choke from perforations in the Oswego lime at 5,925-41 ft.; 133 bbl. of oil in 20 hours on 10/64-in. choke from the Layton sand at 5,452-74 ft.

ROCKY MOUNTAIN

WESTERN NEBRASKA

Morrill Bags Year's First Discovery

The first discovery honors of the year in Morrill County go to Shell Oil Co. The 1 Hascall, C SW NE 6-18n-52w, 3 miles north of Olsen field and ¾ mile from Banner County line, will open Chalk Creek field.

Shell is perforating the "J" sand after recovering 3,500 ft. of oil on a drill-stem test in that Dakota sand at 4,960-65 ft. Location of the apparent new pool is 3 miles west of Stark field, another "J" sand producing area in C NE SE 3-18n-52w.

COLORADO

Kiowa County Wildcat Gets Morrow Gas

A Morrow gas discovery is reported at D. D. Harrington 1 Morse-A, C SE NW 28-20s-48w, 3 miles southeast of McClave-Morrow field in Kiowa County. The Las Animas arch area wildcat flowed at the rate of 750 M.c.f. per day on a drill-stem test at 4,712-43 ft.

MONTANA

Amerada Reports Silurian Shows at Outlook Wildcat

The closely watched 1 Loucks, Outlook area wildcat in Sheridan County, recovered oil shows on a core of the Silurian. Amerada Petroleum Corp. opened the Outlook area at the end of 1956 at 1 Tange, C NE SE 20-36n-53e. This discovery set off a wave of wildcat enthusiasm throughout the entire Williston area. It was completed for 2,742 bbl. of oil daily from 18 ft. of Silurian pay at 9,056-74 ft.

Amerada will make drill-stem test at the Loucks well. A third well is getting under way in the area at 1 Ruegsegger, C NE NE 24-36n-52e, 2 miles northwest of the 1 Loucks.

TEXAS

EAST TEXAS

Smackover Strike Completed

The Texas Co. and Wheelock Oil Co. 1 Edens, northwest of the old Powell shallow field in Navarro County, has been completed as a Smackover gas-distillate discovery.

Final gage was 6,500 M.c.f. of gas, plus 33 bbl. of distillate per 1,000 M.c.f. Production was from perforations at 8,730-70 and 8,868-8,900 ft.

Nearest comparable production is 30 miles south, in the old Mexia field of Limestone County.

Franklin County wildcat . . . Mount Vernon area of north-central Franklin County was reported in line for a Travis Peak wildcat. The test will be

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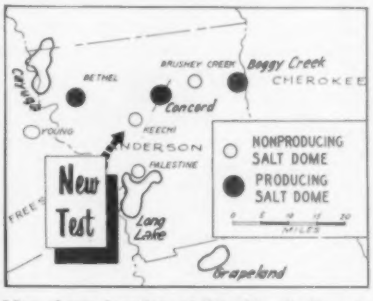
drilled by General Crude Oil Co. and Gulf Oil Corp., according to reports. Initially the well will go to 7,500 ft., but may continue to the Smackover.

Location is expected to be about 3 miles northeast of Mount Vernon, on a 202-acre tract in the Hugh Allen Survey, A-3. Humble Oil & Refining Co., Amerada Petroleum Corp. and Atlantic Refining Co. are said to be supporting the test.

Bethel dome gets new well . . . The Texas Co. S. E. C. Williams has extended Woodbine production to the southwest with a completion potential of 115 bbl. of 31° oil a day. The test was on ⅜-in. choke, with gas-oil ratio of 412:1. Total depth is 5,803 ft., with pipe set at 5,792 ft. Location is in J. N. Acosta Survey, A-1, southwest of the firm's 4 Williams, nearest producer.

Keechi Salt Dome To Be Drilled

The Texas Co. has scheduled another salt dome test in Anderson County. The latest is 1 S. W. O'Flynn, located in the M. Carroll Survey, 6 miles north-



Map shows location of Keechi salt dome in relation to other producing domes in Anderson County. The Texas Co. has scheduled a test on Keechi dome, and location is thought to be on the dome's south flank.

west of Palestine. It will seek Woodbine oil in drilling to 5,700 ft. Location falls on the south flank of the dome.

The Texas Co. opened Woodbine production on Bethel dome in northwestern Anderson County.

NORTH TEXAS

Knox County Drilling Still Going Strong

Ray Smith Drilling Co., Dallas, has completed a small Tannehill sand discovery 3 miles southeast of Munday in Knox County, and has announced locations for four 3,000-ft. wildcats in the county.

The completed well is 1 Frances J. Hill, located on a 115-acre lease in S. Washburn Survey, A-410. It is 1 mile south of 4,500-ft. production in

Cartwright field. Initial potential on the pump was 42 bbl. of 37° oil, plus 1 bbl. of water in 12 hours. Perforations at 1,773-93 ft. were treated with 150 gal. of mud-acid. Top of the upper Tannehill was logged at 1,773 ft., and oil string set at 1,873 ft.

Big Four Ranch properties being drilled are in the northwestern part of Knox County. Ray Smith Drilling Co.'s four additional tests in the area are: No. 3 Big Four Ranch, 9 miles northwest of Truscott in Section 36, Block 4, D&W Survey. Ground elevation is 1,673 ft. No. 4 Big Four Ranch is 8 miles northwest of Truscott, in Day Land & Cattle Co. Survey. No. 5 is 9½ miles northwest of Truscott in Section 105, Block 44, H&TC Survey, and No. 6 is 8½ miles northwest of Truscott in Section 11, Block 1, H&GN Survey. Projected depth on all four tests is 3,000 ft.

The same operator's 1 Big Four Ranch, in 105-44-H&TC, 9 miles northwest of Truscott, was dry at 2,801 ft., and their No. 2, Section 38, Block 4, D&W Survey, southeast of No. 1, was drilling at 1,787 ft. at this writing.

Stephens County . . . Big D Oil Co., Dallas, was waiting on cement at 1 Ross Sloan, wildcat prospect 14 miles north of Breckenridge in Stephens County, after recovering oil on drill-stem test. The 1-hour test, in Mississippian at 4,095-4,119 ft., had gas in 6 minutes and recovered 120 ft. of free oil, plus 5 ft. of heavily oil-cut mud. Shut-in pressure was around 2,010 psi. Location is in Section 1164, TE&L Survey.

Shows in Wise County wildcat . . . Cities Service Oil Co. 1-B Sealy, 4 miles southwest of Chico, reported shows of gas and distillate in a second conglomerate section. On test at 5,217-50 ft., open 45 minutes, the well flowed 3,460,000 cu. ft. of gas in 25 minutes, plus a small amount of distillate. Flowing pressure was 525 psi., and 1,590 psi. when shut in. Location is in Section 19, GH&H Survey, A-352. Drilling continued.

WEST TEXAS

Lamb County San Andres Strike Completed

Delfern Oil Co. 1 Young, wildcat 5 miles southwest of Littlefield in Lamb County, flowed 170 bbl. of oil a day through 24/64-in. choke. Pay section was open hole at 4,116-31 ft. Other completion details were not reported. Location of the well is in Labor 8, League 684, State Capitol Lands Survey, Abner Taylor Subdivision.

First Oil Well Completed In Azalea Field

Azalea field in northeastern Midland County, gained its first oil well at Phillips Petroleum Co. et al, 1 Crespi, located ½ mile north of the field discovery.

No. 1 Crespi flowed oil at the rate of 133 bbl. a day through 1-in. choke, from Devonian pay at 11,460-11,570 ft. Gas flow was 1,620,000 cu. ft. daily. The well had also made flows of gas and distillate from Strawn lime at 10,320 ft. Operators said the well would be dually completed.

Azalea field is 5 miles west of Spraberry Trend fields and 8 miles southeast of Midland. It was opened in March last year at Murphy H. Baxter 1 Heidelberg. Calculated potential was around 11,000,000 cu. ft. of gas plus 1,400 bbl. of distillate from the Strawn at 10,320-40 ft.

Gas from Azalea field is being processed in the nearby Phillips plant in the north end of Spraberry field. Phillips owns 75 per cent in 1 Crespi, and holds 24,431 net acres in the area of the new discovery.

Distillate discovery prospect . . . Meanwhile another distillate discovery was

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in the making 4 miles south of Azalea field at Murphy Baxter 1 Willis, Section 44, Block A, George C. Gray Survey. At last report the well was shut in for storage after flowing 143 bbl. of distillate in 16 hours through 24/64-in. choke. Tubing pressure on the test was 450 psi. Pay section is the Strawn, with perforations at 10,473-83 ft.

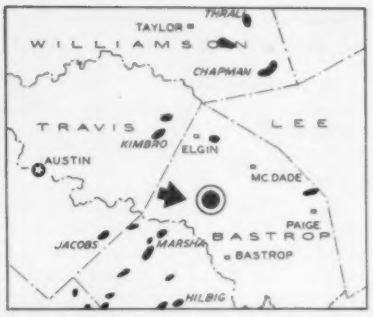
SOUTHWEST TEXAS

Bastrop County Discovery Revives Sayersville Area

Skelly Oil Co. is reviving the old Sayersville area, in the north central part of Bastrop County, on the Balcones fault trend, with an oil-discovery well believed to be producing from the Austin-Eagleford section.

The well, 1 H. N. Bell, was drilled to 3,500 ft., in the Edwards. Its productive zone is perforated at 2,496-2,502 ft. Tested through ¾-in. choke for completion, it flowed 63 bbl. of 27.7°-gravity oil per day with pressure of 100 psi. on the tubing side, and gas-oil ratio of 226 cu. ft. per barrel.

Location, in the Albert Black Survey, is 2 miles west of Sayersville, where three oil-productive wells, now abandoned, previously had been completed. The first, productive from the Edwards, topped at 3,152 ft., was completed, and soon abandoned, in 1940. A Georgetown (top 3,038 ft.) well was completed early in 1952, and a Buda (top 2,875 ft.) well early in 1952.



Location of Skelly Oil Co.'s Sayersville oil-discovery (indicated by arrow) in Bastrop County.

Nearest other production has been in the old Littig area, about 5 miles northwest, and at Elgin, about the same distance north. Littig production was from shallow Navarro sands; that at Elgin from Austin chalk.

Anacacho Zone Produces In Atascosa Oil Discovery

The Upper Cretaceous-Anacacho formation has proved oil-productive in a wildcat well completed by Robert Mossbacher and W. T. Mendell in the South Pleasanton area, 8 miles east of Jourdanton, in Atascosa County. It is the first commercial production recorded from this zone in the county.

The zone is productive from two perforated intervals, 7,441-57 ft. and 7,422-29 ft. Completion gage was at the rate of 392.52 bbl. of 27°-gravity oil per day, flowing through ¾-in. choke. The well, 1 Butts and Swayer, located in the J. Poitevent Survey, was drilled to 8,193 ft. in the Edwards.

Map Review

The Midland Map Co. 412 North Spring Street, Midland, Tex., has released a new map of the Williston basin showing oil fields, county seats, and all major highways. The map is revised to January 1957.

Midland Map has also released a Development Map for 1956 of West Central and North Texas oil and gas fields.

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H.B. Union 1 East Kaybob, LSD 6, 20-61-18w5. TD 7,776 ft. Viking gas well.

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Union 11-21 Red Earth Creek, LSD 11, 21-87-8w5 (step-out). TD 4,800 ft. Granite wash oil well.

Union Imperial 3-9 North Fairydell, LSD 3, 9-58-24w4. TD 4,005 ft. Basal quartz gas well.

BRITISH COLUMBIA

White Lloyd Fargo 3 Halfway, LSD 12, 12-87-25w6. TD 7,701 ft. Triassic gas well.

CALIFORNIA

Colusa County: Western Gulf Oil Co. 1 Arbuckle Unit-C, SE SE 3-13n-2w, IPF 7,600 M.c.f., ½-in. choke, shut-in pressure 2,830 psi., perfs. 5,580-5,608 and 5,873-5,910 ft., TD 6,510 ft. (New gas field discovery in Arbuckle area.)

Kern County: Western Gulf Oil Co. 44-21 Bloemer, SE NW 21-30s-29e, IPF 14 bbl. of condensate, 69° gravity, 1,650 M.c.f. gas, 30/64-in. choke, perfs. 5,276-5,310 ft. in Jewett zone, TD 5,509 ft. (Deeper pool discovery in West Edison area.)

Glenn County: E. L. Dohency 2 Dohency-N.G.-G.P., NW SW 27-20n-2w, IPF 5,250 M.c.f. gas daily, ⅜-in. choke, 1,620 psi. tubing pressure, perfs. at five intervals between 5,270-5,338 ft., TD 6,963 ft. (Extension to Beehive Bend field.)

Los Angeles County: General Exploration Co. 24 C.W.O.D., 17-2s-12w, IPP 100 BOPD, 35° gravity, 34/64-in. choke perfs. 8,329-8,561 ft., TD 9,484 ft. (Miocene sand discovery in Bandini field.)

KANSAS

Barber County: East Turkey Creek pool was opened at Aylward Drilling Co. 1 Walker, SE SE NE 21-30s-15w. Completing in Viola. TD 4,751 ft.

North Highway pool opened at Byard Bennett 1 Schiff "B," SW SW NW 11-32s-11w. Completing in Mississippi. TD 4,450 ft.

Barton County: East Cheyenne View pool opened at Petroleum, Inc., 1 Hammeke "A," SE NW SW 13-19s-12w. Completing in Lansing. TD 3,430 ft.

Cowley County: East Rainbow Bend pool opened at L. C. Smitherman 1 Wright, NE SW SW 14-33s-3e. IPP 25 BOPD, Bartlesville-Penn. TD 3,343 ft.

Waldschmidt pool opened at Crest Petroleum 1 Waldschmidt, NE NW NW 8-34s-6e. OWWO. IPP 25 BOPD, Mississippi. TD 3,120 ft.

Decatur County: Cathcart pool opened at Cities Service Oil Co. 1 Cathcart, SE SW SE 17-1s-27w. IP 26 BOPD, Lansing. TD 3,616 ft.

Ellis County: Northwest Sweet William pool opened at I. O. Miller 1 Hamburg, NW SE SW 4-12s-20w. IP 243 BOPD, Lansing. TD 3,976 ft.

Scurlock pool opened at Coppinger Drilling Co. 1 Scurlock, SE SE SE 20-15s, 16w. Completing in conglomerate. TD 3,485 ft.

Graham County: Higer pool opened at L. J. Dreiling 1 Higer, SW SW NW 20-8s-23w. IP 41 BOPD, Lansing. TD 3,760 ft.

Northwest Evergreen pool opened at Imperial Oil Co. 1 Robinson, NW NW SE 17-9s-23w. IP (on bomb test). 1,727 BOPD, Lansing. TD 3,895 ft.

Greenwood County: Fancy pool opened at Charles Sandburg 1 fee, C W½ E½ SW 25-26s-12e. IP 5 BOPD, Mississippi. TD 1,648 ft.

Harper County: Gish pool opened at Skelly Oil Co. 1 Gish, SW SE SW 17-31s-6w. Completing in Simpson. TD 4,920 ft.

Harvey County: South Sperling pool opened

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at Bennett & Gould 1 Mennonite Church, SW SW SE 23-22s-2w. Completing in Viola and Simpson. TD 3,515 ft.

Hodgeman County: West Jetmore pool opened at Petroleum, Inc., 1 Springer, SW SW SW 23-22s-24w. OWWO. Completing in Mississippi. TD 4,702 ft.

Marion County: Southeast Lehigh pool opened at R. Jones 1 Schroeder, C S½ S½ NW 35-19s-1e. Completing in Mississippi. TD 3,319 ft.

Reno County: Wisby pool opened at White & Ellis 1 Wisby, NE NE NE 18-22s-9w. OWWO. Completing in Simpson. TD 3,725 ft.

Ijams pool opened at Western Hydrocarbon 1 Swanson, SE SE NW 22-23s-5w. Completing in Hunton. TD 3,971 ft.

Sedgwick County: Wichita pool opened at Derby Refining Co. 1 fee, C SE SE 4-27s-1e. Completing in Viola. TD 3,352 ft.

West Brumley pool opened at Newman Bros. 2 Emma Roy, SE SE SW 13-29s-1w. Completing in Miss. TD 3,352 ft.

SOUTHERN LOUISIANA

Acadia Parish: Humble Oil & Refining Co. 1 Mire et al, 32-8s-3e (1½ miles west of Bosco field). IP 12 BCPD and 1,089 M.c.f. daily, ⅛-in., 48.9°, perforations 9,542-52 ft. (Frio). TD 13,500 ft. (Extension and new pay for Bosco field.)

Calcasieu Parish: Sun Oil Co. 1 Lock-Moore, 4-10s-9w (northern flank of Lockport dome). IP 192 BOPD, 3/32-in., 29°, GOR 859 cu. ft. per bbl., perforations 8,815-24 ft. TD 10,005 ft. (Extension and new pay at Lockport.)

Jefferson Davis Parish: Continental Oil Co. 1 Quatre Parish, 26-7s-7w (2½ miles west of Indian Village field). IP 114 BCPD and 1,812 M.c.f. daily, 3/16-in., 59.4°, perforations 8,390-8,409 ft. (Nodosaria). TD 8,825 ft. (Discovery well West Bayou Serpent area.)

Lafourche Parish: The Texas Co. 63 LL&E-Golden Meadow, 71-19s-21e. Potential gas well, standing unperforated with 5-in. liner at 15,576 ft. TD 16,783 ft. (Extends Golden Meadow field.)

Terrebonne Parish: C. G. Glasscock and Tidelands Oil Co. 1-B Continental, 50-17s-15e. Shutin gas well, no gage, perforations 10,718-22 ft. TD 12,037 ft. (New field 3 miles northwest of Orange Grove-Lake Hatch area.)

Humble Oil & Refining Co. 1-B State lease 1038, Block 67, South Timbalier area, Gulf of Mexico. Potential gas well, standing unperforated with 7-in. casing at 12,679 ft. TD 13,000 ft. (New pay in South Timbalier Block 54 field.)

Vermilion Parish: Shell Oil Co. 1 Shell-Humble OCS Lease 0493, Block 164, Vermlion area, Gulf of Mexico. IP 220 BOPD and 99 M.c.f. daily, 9/64-in., 43.2°, perforations 6,758-72 ft. TD 8,493 ft. (New offshore field.)

NORTHWEST NEW MEXICO

Rio Arriba County: Magnolia Petroleum Co. 1 Cheney-Federal, NE SW SW 8-26n-2w. IP 6,700 M.c.f. of gas per day, Mesaverde discovery, new field. TD 6,150 ft. Mancos.

SOUTHEAST NEW MEXICO

Shell Oil Co. 1 Querecho Plains Unit, NE NW 22-18s-32e. IP 221 BOPD, 1-in., TP 60 psi., GOR 1724, 42°, Pennsylvanian perforations 11,595-11,625, 11,640-60 ft. TD 14,217 ft., PB 11,745 ft., elev. 3,767 ft. Tops: Atoka 11,690 ft., Mississippian 13,142 ft., Woodford shale 13,704 ft., Devonian 13,828 ft.

NORTH DAKOTA

Bottineau County: Leach Oil Co. 1 R. R. Smith, C SW SW 14-162n-80w. IPP 25 BOPD, 5 BWPD, Spearfish discovery, new field. TD 3,680 ft. Mission Canyon.

PENNSYLVANIA

Indiana County, Young Township: Manufacturers Light & Heat Co. 2 R. & P. Coal Co., (Neal), 1,812,000 cu. ft. gas, after fracture. Chert 7,473 ft., gas 7,527-40 ft., Oriskany sand 7,616-35 ft., gas 7,618 ft., Helderberg lime 7,635 ft. TD 7,711 ft.

SOUTHWEST TEXAS

Hidalgo County: Pure Oil Co. 1 Felix Mettini, Lot 99, Blk. 4, Porcion 52, Jose Francisco de la Garza Sur., A-579. IP 41,000 M.c.f. daily, open-flow potential, GOR 80 M.c.f. per barrel, 60.1°, perfs. 6,559-69 ft. (Frio). TD 8,510 ft. (New pay in West Sharyland field.)

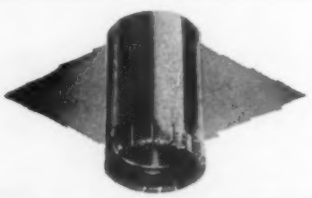
Jim Hogg County: George H. Coates 1 Pena et al, El Peyote Grant, Survey 587, Share 4, Blk. 47. IP 39.91 BOPD (net), 7/64-in., 35.1°, water 36 per cent, perfs. 6,156-65 ft. (Frio). TD 6,167 ft. (New field—El Peyote.)

Jim Wells County: S. H. Howell 2 Paul White estate, Blk. 10, Nueces City School Lands. IP 222 BOPD, ⅜-in., 42°, GOR 1,635 cu. ft. per barrel, perfs. 6,380-86 ft. (Pettus). TD 6,420 ft. (New pay in Paul White field.)

NORTH TEXAS

Wichita County: Henry Grace Production Co. 1 Lula Kell, Sec. 26, Lge. 1, Denton CSL, 3 mi. S Wichita Falls. IPP 38.5 BOPD, 38°, GOR 240, Upper KMA sand 3,897-3,910 ft. TD 3,963 ft. New field name: Akin-Dimock (Upper KMA).

"Let me hear that part again, Finchley—where you threaten to quit if the work gets any harder."



D&S washover shoes save time . . . money!

D & S Truco diamond washover shoes perform many extraordinary feats in the oilfield. For example: When a portion of casing collapsed . . it, the tubing, packer, and anchor joint were retrieved inside the washpipe in 3 days rig time using a D & S washover shoe. Proof-positive of savings in time and money with D & S equipment.

WRITE OR CALL TODAY! One of our sales engineers will call on you and explain our custom-services and equipment. Herein lie the real D & S advantages.

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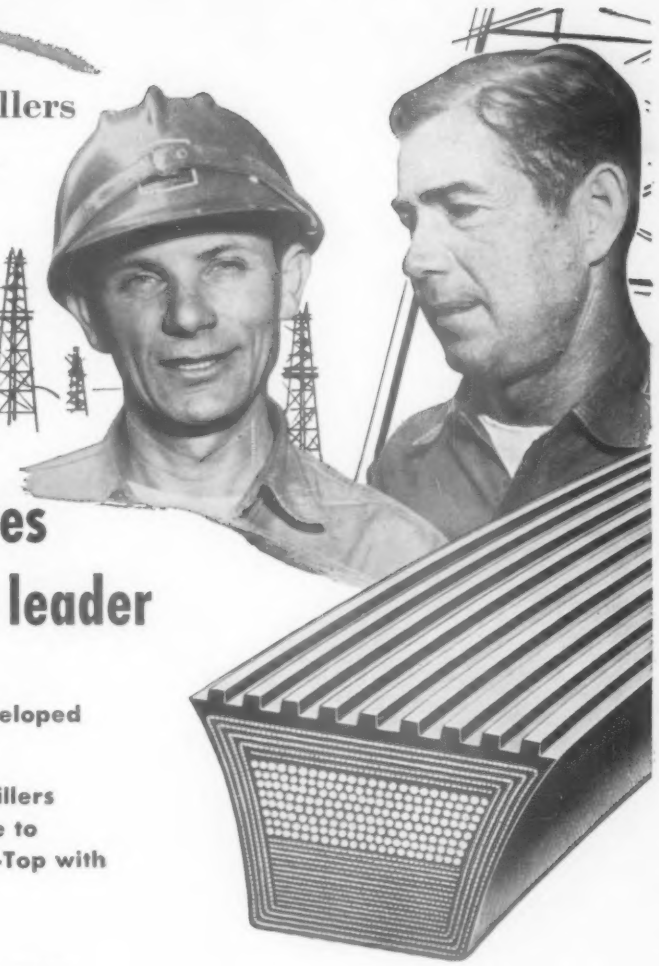
"...used by more drillers on more mud pumps than any other V-belt made"

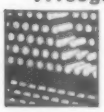


4 engineering features make Rib-Top world leader

You save money... save time... when you order Gates V-Belts — developed *specifically for mud pump drives.*

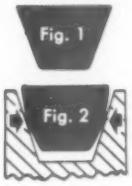
In oil fields around the world, drillers reduce the work delays and costs due to belt replacement, by using Gates Rib-Top with these four important features:—

1. Tougher, More Resilient Tensile Cords.



Enable Rib-Top V-Belts to absorb severe pulsations of the mud pump—easily handle peak loads.

2. Concave Sidewalls (U.S. Pat. No. 1813698).



Provide sure pulling power, less wear, longer V-belt life, because as belt bends around a sheave, concave sides fill out...become straight ...fit sheave grooves evenly (Fig. 1). Straight-sided belts bulge at the sides when bent. Uneven contact (Fig. 2) causes uneven wear, shorter belt life.

3. Stabilizing Ribbed Top (U.S. Pat. No. 2548135)

Dampens vibration . . . protects top of belt against damage . . . keeps belt running smoothly over idler-equipped mud pump drives, with no side whip.

4. Flex-Weave Cover (U.S. Pat. No. 2519590).

Insures greater flexibility with far less stress on fabric. Wears longer . . . increases belt life . . . lowers belt costs . . . makes more power available to driven machine.

You pay no more for Rib-Tops than for ordinary belts of comparable ratings. Both Standard and Super Rib-Top V-belts are available from your oil supply house. Specify Gates Rib-Top next time you order. The Gates Rubber Co., Denver, Colorado—*World's Largest Maker of V-Belts.*

For Toughest Drives Use *Super* Rib-Top

40% greater horsepower capacity. Handles drive overloads and shock loads easily. Increased capacity solves weight and space problems by permitting narrower sheaves and fewer belts.

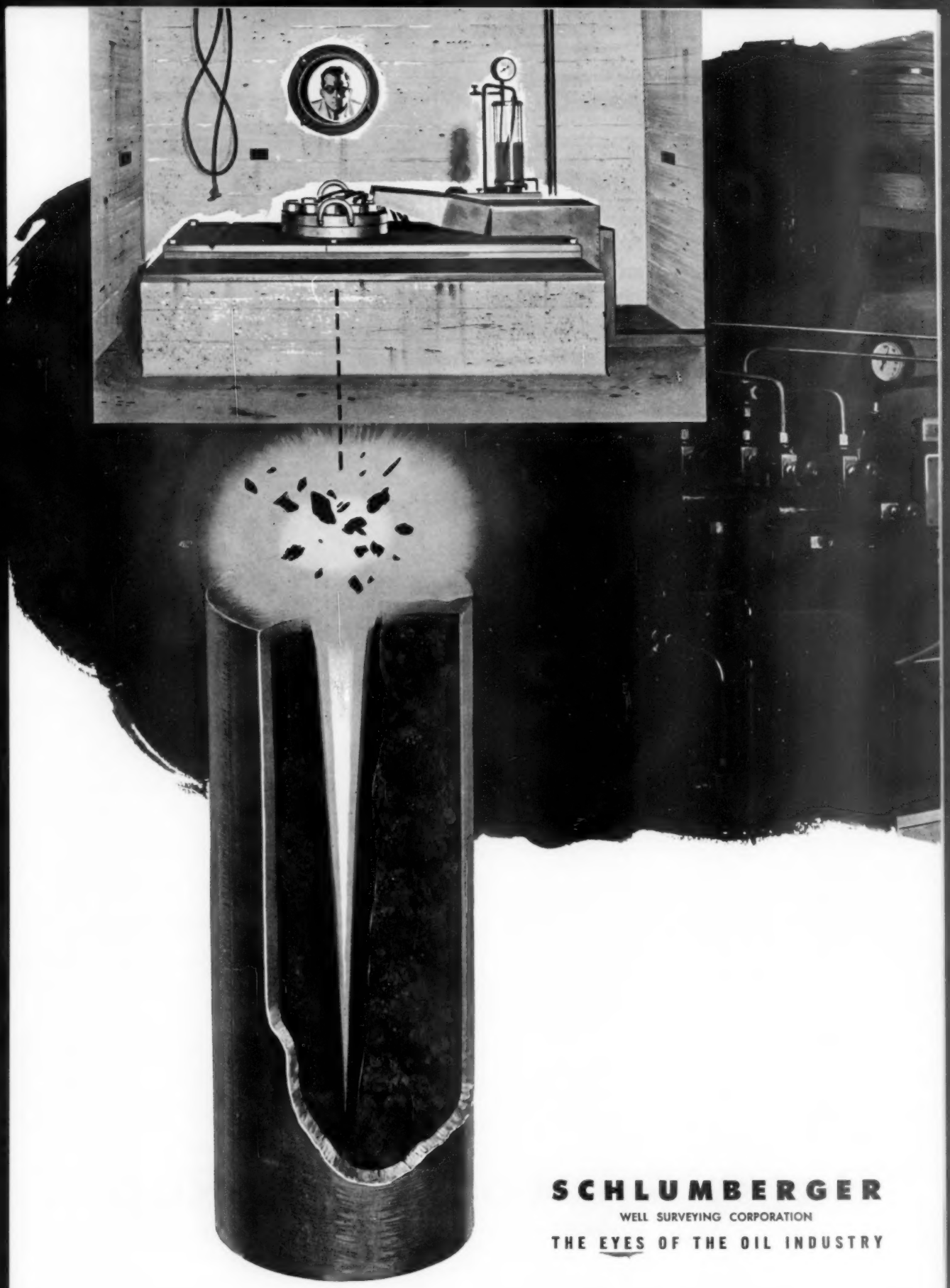
Gates®

The Mark of Specialized Research

TPA 92

Gates Rib-Top Vulco Rope

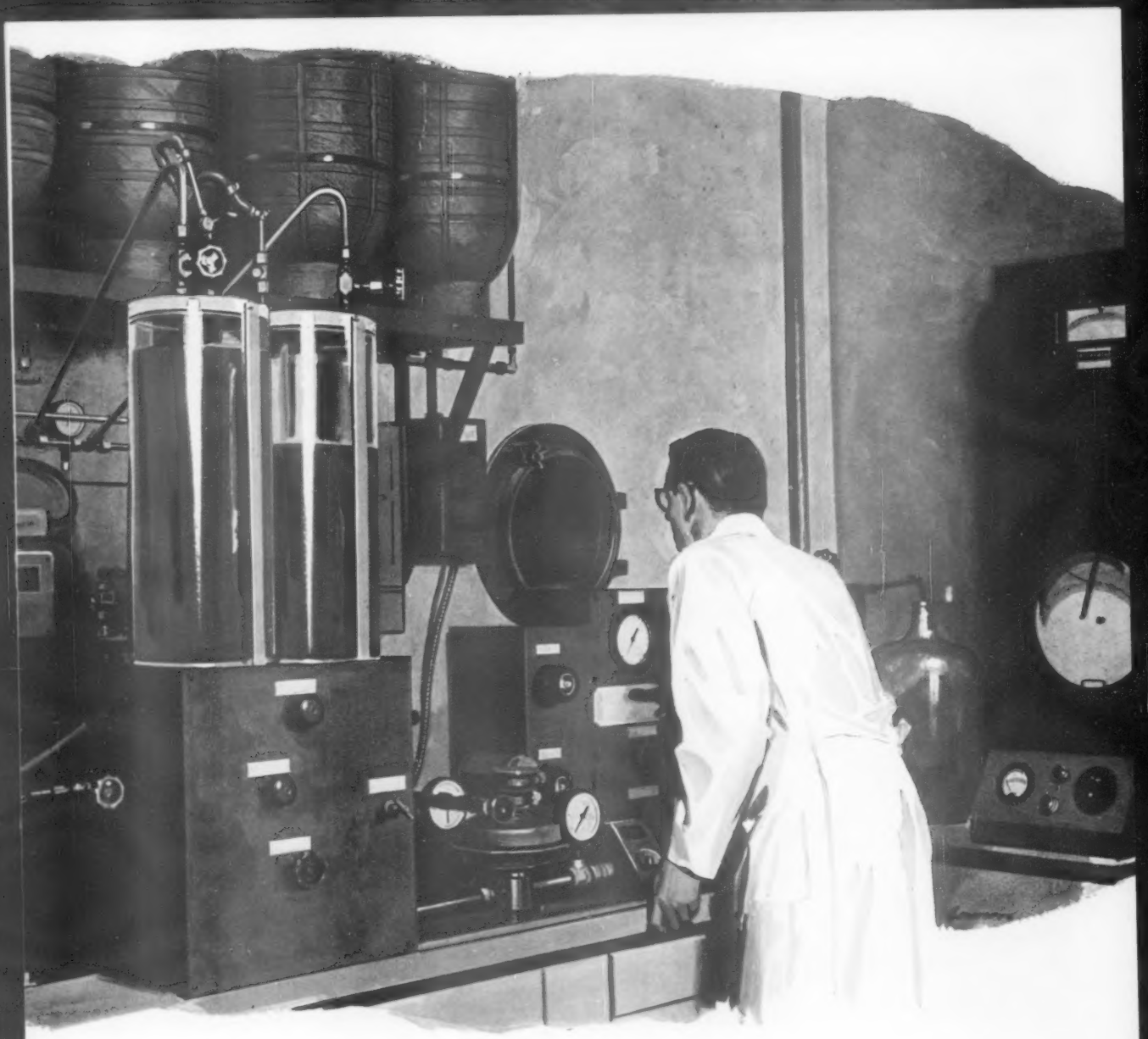
DEVELOPED ESPECIALLY FOR MUD PUMP DRIVES



SCHLUMBERGER

WELL SURVEYING CORPORATION

THE EYES OF THE OIL INDUSTRY



New from Schlumberger ---
MAXIMUM FLOW PERFORATIONS

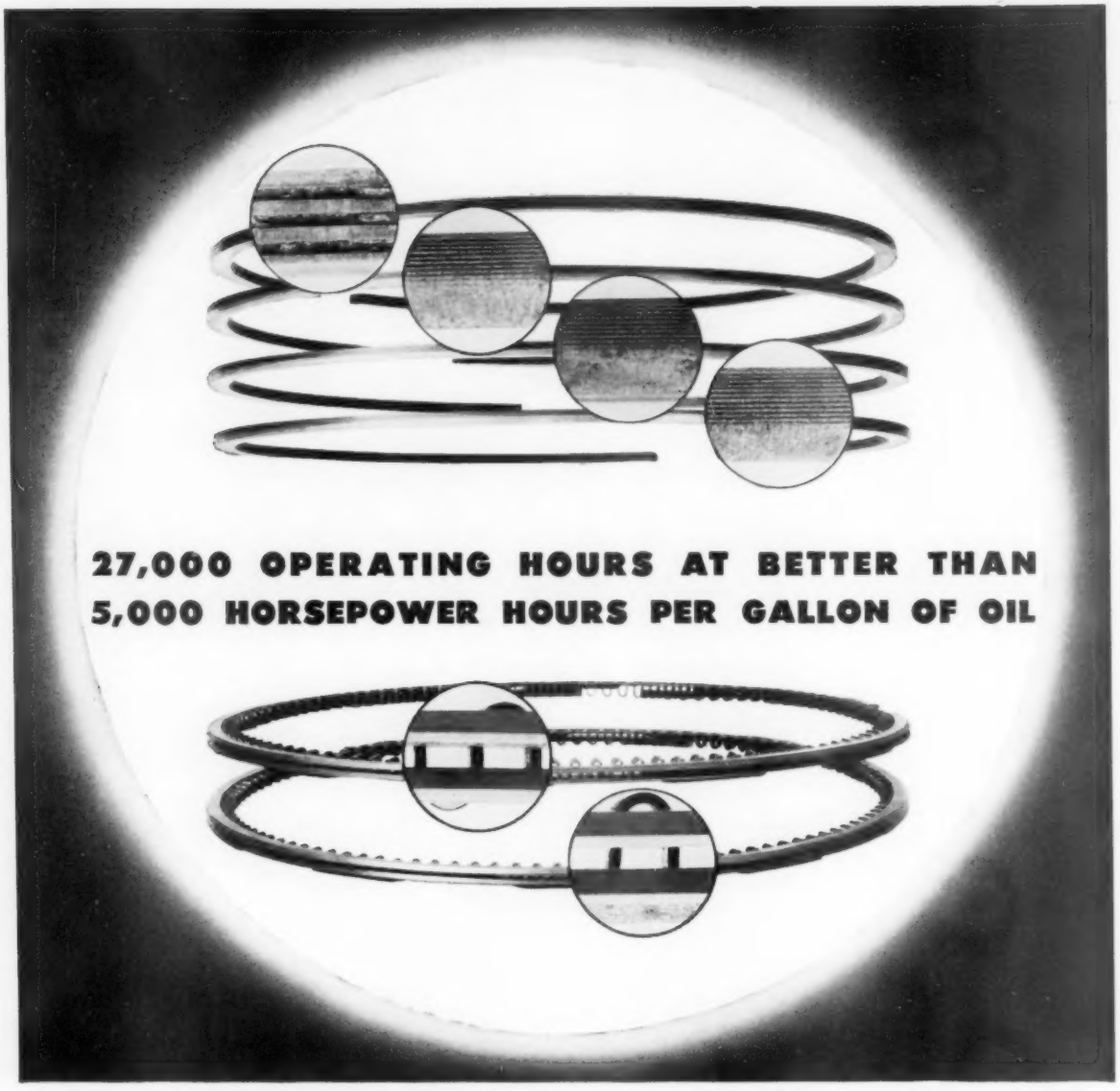
The new Schlumberger flow index laboratory provides the most complete gun testing facilities in the oil industry today. It is the first and only laboratory of its kind being operated by a service company.

In the past, Schlumberger has tested gun performance under extremes of pressure and temperature. Now, it is also possible to fire guns under formation-to-hole pressure differentials identical to those existing underground.

As fluid is forced through the perforations, a definite flow index is accurately established for different types of perforations and formations.

When you call Schlumberger, you can be sure that the perforator used on your well has been pre-tested under field conditions to give perforations with a maximum flow rate.

Schlumberger...to be sure!



27,000 OPERATING HOURS AT BETTER THAN 5,000 HORSEPOWER HOURS PER GALLON OF OIL

ENGINEERED RING SETS IS A PEDRICK FIRST

In 1921, the first complete set of rings in a single package, engineered for a particular internal-combustion engine, was introduced *by Pedrick*. You get 35 years of experience and know-how, therefore, in the complete sets we engineer for diesel and gas engines.

That's part of the reason Pedrick Engineered Sets give the kind of performance revealed by the un-retouched photo above. These rings are from a Pedrick E3902 Set taken out of a Cooper-Bessemer GMV engine after 27,109 hours of operation. Oil consumption averaged better than 5,000 hp. hrs. per gal. Wear in the cylinders was almost insignificant—averaging only .00725 in. at the top and .0035 in. at the bottom. Ring tension remains at practically original production level. Each ring shows face-wear only about halfway up, so rings still are practically as good as *new!*

For *your* engine's own good, use Pedrick Engineered Sets with the latest ring designs in proper combination, illustrated installation instructions, a single package per cylinder. You'll also enjoy the benefits of simplicity in ordering and stocking. The same engineering know-how which goes into Pedrick Engineered Sets is available to help you with special problems. Write, wire or phone: WILKENING MANUFACTURING CO., Philadelphia 42, Pa. SAratoga 9-3770. In Canada: Toronto 2.

Pedrick HEAT-SHAPED **PISTON RINGS**

PEDRICK PRECISIONEERING KEEPS PEDRICK FIRST

Socony's new coordinator sees . . .

. . . Oil Becoming More Elusive

FINDING and producing oil in the United States will get tougher before—if ever—it gets easier.

That's the opinion of a man who watches over 285,000 bbl. per day of crude production in the United States and 27,000 bbl. per day in Canada.

He is William W. Clawson, who recently became coordinator of domestic production and a member of the producing committee for Socony Mobil Oil Co. In doing so, he moved from a "little old office" in Billings, Mont., to quarters on the thirty-first floor of the new Socony building in midtown Manhattan—quite a change, as he puts it, for a "country boy."

Clawson's job is to act as liaison between Socony Mobil's producing department and its domestic and Canadian affiliates. Some of these are Magnolia Petroleum Co., General Petroleum Corp., and Mobil Producing Co. Socony and its affiliates cover the country from coast to coast and border to border. They operate entirely independently and coordinate only at and above the Clawson level.

Big job . . . Socony Mobil's producing committee coordinates the company's production. The role of domestic and Canadian production in the overall picture is Clawson's concern. It's a staff function, with a minimum of administrative responsibilities involved.

Clawson's rating as an expert on crude oil is not assumed. It is based on the fact that he has worked with it for more than 30 years. He was graduated from the University of Kansas in 1923 with a degree in mining engineering and has been at it ever since.

His first job was with Indian Territory Illuminating Oil Co., which brought in Oklahoma City field and later merged with Cities Service Co. After 1½ years Clawson went to Venezuela with Lago Oil & Transport Co., Ltd., then a Standard of Indiana subsidiary. He was there when Lagunillas field was discovered in Lake Maracaibo.

After returning to the U. S., Clawson rejoined Indian Territory Illuminating Oil. He stayed with the company until 1933 when he joined the Socony organization as a geologist in the Dallas office of Magnolia. He was named chief geologist in 1946.

In 1952 Clawson left Magnolia to take over as president of Mobil Producing Co. and Mobil Oil of Canada, Ltd. He held those positions when he was transferred to the parent company's home office in New York.

WILLIAM W. CLAWSON
. . . No room for pessimism

Offshore pioneer . . . Clawson prefers action to words. Ask him if there were any significant developments at Magnolia while he was chief geologist, and he'll say: "Magnolia's production and development grew in that period."

The reference is typical. He doesn't mention the fact that Magnolia was a pioneer in offshore operations in the Gulf of Mexico, the biggest thing in oil exploration in this country in years.

Clawson's chief interest among his "extra-curricular" activities has centered on the Montana School of Mines. He served on the school's advisory committee when he lived in Billings. In 1955 he gave the commencement address and was presented with an honorary doctorate of engineering.

Clawson sees crude-oil exploration and production becoming more costly, more difficult, and more competitive. All of which makes petroleum a more and more complex business. He acknowledges that refinery realization is becoming more of a factor in evaluating crudes and that the influence of the gravity scale is dwindling.

This might indicate that he is pessimistic about oil's future. He's not. There are "too many unbelievers already," he says.

R. W. Chase, zone exploration manager at Casper, Wyo., for Gulf Oil Corp., has joined Midwest Oil Corp. as manager of exploration in the Rocky Mountain area and Canada.

Personals

William J. Parson has been promoted from staff geologist to assistant division geologist at Midland, Tex., by Texas Pacific Coal & Oil Co.

Weldon C. Julander, senior geologist with Pan American Petroleum Corp., has resigned to open consulting offices in Albuquerque.

Bertram I. Sparr has been appointed technical representative to the New York technical service department of Shell Chemical Co.

James Mays has been named executive vice president of Evans Production Co., Dallas, replacing **Don J. Shaw,** who resigned to become an independent operator.

Donald B. Pruess, formerly with Cities Service Petroleum, Inc., has been appointed superintendent of manufacturing for Cities Service Oil Co. (Pa.) with headquarters in New York.

Robert L. Walker has been appointed division mechanical engineer for Shell Oil Co. in Kilgore, Tex. Walker has been on assignment in The Hague, Netherlands, and New York for the past year. He was formerly division mechanical engineer at Denver.

W. S. PEELER

Winston S. Peeler, general superintendent of the administrative department of American Oil Co.'s Texas City refinery, has been promoted to general manager of manufacturing for the company in New York. Peeler has been with the company since 1934. He has been general superintendent of the administrative department since 1953. Peeler succeeds **Roy J. Diwoky,** who recently resigned to join Commonwealth Oil Refining Co., Inc.

Richard V. Hollingsworth of Paleontological Laboratory, Inc., Midland, Tex., has been elected 1957-58 president of the Society of Economic Paleontologists and Mineralogists. Other officers are **Stuart A. Levinson,** Humble Oil & Refining Co., vice president; **Samuel P. Ellison, Jr.,** University of Texas, secretary-treasurer; and **M. L. Thompson,** University of Kansas, editor of Journal of Paleontology. The slate will take office after the society's annual meeting in St. Louis, April 1-4.

Personals

Troy M. Roberts, production foreman with Samedan Oil Corp., has been transferred to Lafayette, La., from Alma, Okla.

Howard R. Geier, drilling and production engineer with Union Oil Co., has been transferred to Edmonton, Alta, from Los Angeles.

R. L. Fentem, seismic party chief with Amerada Petroleum Corp., has been transferred to Enid, Okla., from Alva, Okla.

Harvey Cash, assistant to the chairman of the board of The Texas Co., has been elected a director of Seaboard Oil Co. He replaces **R. F. Baker,** who resigned when he retired from The Texas Co. last month.

Kenneth A. Stierman, senior engineer with Sohio Pipe Line Co., has been promoted to group supervisor in charge of construction. Stierman joined Sohio in 1951. **Frank G. Hausmann,** engineer with Sohio, has been promoted to senior engineer.

Homer E. Roberts of Petty Geophysical Engineering Co., has been elected president of the Casper, Wyo., Geophysical Society. **Dupree McGrady,** Western Geophysical Co., is vice president with **Richard L. Billings,** Forest Oil Corp., secretary-treasurer.

Joseph T. Froehlich, formerly superintendent of special assignments for The Texas Co.'s refining department, New York, has been named superintendent of the 40,000-bbl. per day Anacortes, Wash., refinery which the company will begin building in March. The refinery is expected to be completed in 1959. Froehlich has been with Texaco since 1929.

J. D. Davis, superintendent of United Gas Pipeline Co.'s western pipeline division, Shreveport, La., has been named assistant to **Ed Parkes,** president of United Gas Pipeline, Union Producing Co., and executive vice president of United Gas Corp. Davis succeeds **D. D. Dillingham, Jr.,** who was recently promoted to executive vice president of United Gas Pipeline. Davis was district manager of the company's Jackson, Miss., district before going to Shreveport.

Gulf Coast Geological Societies Elect Officers

Harold N. Hickey, second from left, The California Co., New Orleans, is new president of Gulf Coast Association of Geological Societies. Others are, left to right, Porter Montgomery, Pan American Petroleum Corp., San Antonio, new vice president; Hickey; Robert L. Layden, Sun Oil Co., San Antonio, past president; and Michael W. Beckman, consultant, Shreveport, past vice president.

H. L. Tirey, Jr., has been named Rocky Mountain division geologist for Texas Pacific Coal & Oil Co.

Robert W. Scarth, engineer with J. M. Huber Corp. in Borger, Tex., has been appointed district superintendent of the company's new Odessa, Tex., production district.

Louis G. Zimmer, geologist with Ohio Oil Co. in Wichita, has joined J. M. Huber Corp. as assistant to **A. S. Magaw,** Oklahoma district geologist at Wichita.

John E. Kasch, manager of research and development for American Oil Co., has been elected a vice president and director of the company. Kasch has been with American since 1942.

John B. Herrington, field drilling and production superintendent for Union Producing Co. in the Pettus, Tex., area, has been appointed drilling and production superintendent in the Tyler, Tex., district. He succeeds **David R. Teel,** who has retired. Teel had been superintendent of the Tyler district since 1946. Herrington joined Union in 1930.

C. V. Walton, Pan American Petroleum Corp., has been elected president of the new Petroleum Club at Salt Lake City. Vice presidents are **W. I. Harris,** Christensen Diamond Products, and **L. S. Fuller,** El Paso Natural Gas Co. **Melvin Leslie,** Skyline Oil Co., is secretary, and **E. W. Mitchell,** El Paso Natural Gas Co., is treasurer.

J. W. Bondurant, chief gager with Mid-Continent Pipe Line Co. in Maysville, Okla., has been promoted to district superintendent there.

E. Russell Griffith has joined Texas Gas Transmission Corp. as research engineer. Griffith was formerly with the American Gas Association.

Edward A. Gribi, Jr., consulting geologist in Great Falls, Mont., has joined Bandini Petroleum Co. in Los Angeles as a geologist.

John M. Heller, zone production engineer with Gulf Oil Corp. in Oklahoma City, has been appointed area drilling supervisor in the Denver production division and transferred to Durango, Colo.

Elwood Kisby, vice president of Michigan-Ohio Pipeline Corp., Mount Pleasant, Mich., has been elected president. He succeeds **Charles A. Schrader** who was recently named vice president of supply and transportation for Leonard Refineries, Inc. Kisby has been with Michigan-Ohio since 1950.

James D. Morris, geological consultant, has joined Petroleum, Inc., as Kansas - Oklahoma division geologist. **Lyman Hill,** assistant district geologist in Kansas, has been promoted to Colorado district geologist and transferred from Wichita to Denver. **James H. Freeland,** Kansas-Oklahoma district landman, has been promoted to division landman.

George Anderman, formerly geologist with Gulf Oil Corp. in Denver, has opened consulting offices there.

C. L. Perkins, vice president and general manager of El Paso Natural Gas Co., has been elected president of

C. L. PERKINS

H. F. STEEN

El Paso Natural Gas Products Co., a wholly owned subsidiary. He succeeds **Paul Kayser,** president of the parent company, who becomes chairman and chief executive officer of El Paso Natural Gas Products. Perkins will continue as vice president and director of the parent company. **Hugh F. Steen,** vice president and general superintendent of El Paso Natural Gas, has been promoted to manager of pipeline operations, a new department created to separate pipelines from other company activities. **C. C. Cragin,** former officer and now a consultant to El Paso, has been elected a director of the products company, which expanded its board from six to seven members.

C. T. Steele, formerly with Esso Standard Oil Co., has transferred to Imperial Oil, Ltd., affiliate of Esso, as coordinator of chemical products research in the research department, Sarnia.

Lonnie G. Shivers has been named reservoir engineer for Atlantic Refining Co. and transferred from Corpus Christi, Tex., to Lafayette, La. **Thomas J. Powers** has been named field engineer at Corpus Christi.

J. C. Hughes, senior research engineer for Continental Oil Co., has been promoted to research group leader at Ponca City, Okla. **L. D. Wann,** research engineer, has been named senior research engineer, Ponca City.

Bill Ward has been appointed head of the technical service division's lube, wax, grease, and asphalt group at Esso Standard Oil Co.'s Bayway refinery, Linden, N. J. Ward has been with Esso since 1951. He replaces **Andy Kean,** now head of refinery planning coordination group.

Peter F. Chapman, division reservoir engineer for Shell Oil Co., has been transferred to Midland, Tex., from Hobbs, N. M.

Bill Eggers, geologist with Continental Oil Co., has been transferred to Lafayette, La., from New Orleans.

T. G. Brown, tool pusher for Nichols Drilling Co., Inc., has been transferred to Haynesville, La., from Whitesboro, Tex.

D. W. Gordon, foreman with Amerada Petroleum Corp., has been transferred to Monahans, Tex., from Eunice, N. M.

Harold E. Jones has resigned a geological job with Pan American Petroleum Corp. in Midland, Tex., to become division geologist at Midland for Bankline Oil Co. He replaces **William B. Dansfield,** who resigned recently to do consulting work.

Harry Lee Johnson, Jr., has been appointed manager of technical service for Black, Sivalls & Bryson, Inc., Oklahoma City. He has been doing research and designing in lease automation for the company.

Joseph W. Bowers, senior analytical chemist for Continental Oil Co., has been named resident chemist in the company's Sherwood refining division, petrochemicals department, Gretna, La.

Benjamin L. Odom has been named operations engineer supervisor for Atlantic Refining Co. in Dallas. **F. Cullen Williams** of the Dallas office has been appointed district engineer in Odessa, Tex.

Don G. Vieaux, geologist with Phillips Petroleum Co. in Denver, has been transferred to Corpus Christi, Tex. **Walter S. Olson,** formerly in the Corpus Christi office, will replace Vieaux in Denver.

D. S. Kirklin has been named head of the new office which Gardner Brothers Drilling Co. of Dallas has opened in Calgary. The company currently has one rig, a National 75, rated for 11,000 ft., working in Alberta.

J. B. Mitchell has been named chief of the leasing branch of U. S. Geological Survey. He succeeds **H. G. Barton,** who has retired. Mitchell was with the Geological Survey 27 years before leaving 3 years ago to become a petroleum consultant.

Personals

Edward Oliphant, Jr., has been appointed group leader at the Sugar Creek, Mo., research laboratory of Standard Oil Co. (Ind.).

Dolores Rolandson, formerly with Universal Oil Products Co., has joined the research department of Standard Oil Co. (Ind.) at the company's Whiting, Ind., research laboratories.

John G. Cameron has been transferred from Abilene, Tex., to Midland, Tex., to become district production superintendent at Midland for Champlin Oil & Refining Co. in the West Texas-New Mexico area. **Paul Gray** will move from Kermit to the new Midland production office as district engineer.

J. R. GETTY

J. Ronald Getty, managing director of Veedol G.m.b.H., marketing subsidiary of Tidewater Oil Co. in West Germany, and manager of export activity for Tidewater in Europe, the Middle East, and Africa, has been named a director of the company. Getty succeeds the late Fero Williams. Getty has been managing director of the West German subsidiary since 1955.

DEATHS

Samuel G. Keller, 65, retired manager of Socony Mobil Oil Co.'s Trenton, Mich., refinery, died recently in Gainesville, Tex.

Warren W. Baker, 65, retired vice president of Sinclair Refining Co., died February 9 in Paris, Ill. Baker retired in 1950.

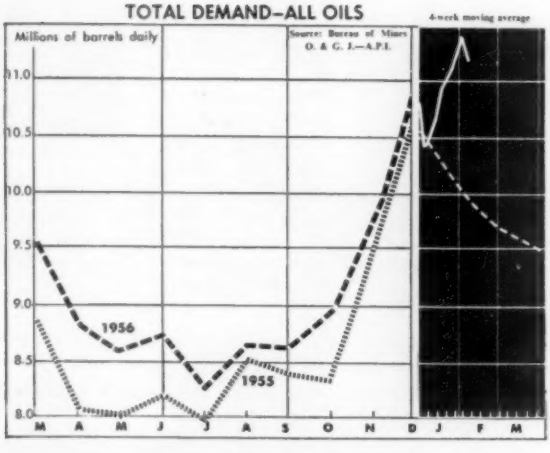
Richard M. (Dick) Tuttle, 60, president and founder of Pact Gas Co., Cushing, Okla., died February 8 in Cushing.

W. Horace Williams, 74, New Orleans contractor, died February 6 in New Orleans after a heart attack. Williams retired 5 years ago as president of W. Horace Williams Co. The company merged with McWilliams Dredging Co. to form Williams-McWilliams Industries, Inc., last year.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,454,275	UP	30,170	UP	313,173
Crude stocks	253,991,000	DOWN	199,000	DOWN	4,219,000
Completions	1,150	UP	77	DOWN	77
Refinery runs	8,119,000	DOWN	83,000	UP	103,000
Gasoline stocks	199,895,000	UP	3,544,000	UP	12,277,000
Kerosine stocks	23,614,000	DOWN	1,008,000	UP	3,545,000
Distillate stocks	93,516,000	DOWN	6,853,000	UP	12,947,000
Residual stocks	37,042,000	DOWN	1,160,000	DOWN	685,000
Four-product stocks	354,067,000	DOWN	5,477,000	UP	28,084,000
Total imports	1,512,300	UP	103,700	UP	143,100



Gasoline Stock Gains Are Under Last Year, But Must Be Cut Even More

DON'T let gasoline-stock comparisons fool you. It will take more than a record of the change for the current week and a comparison with last year to give the full picture.

For example, finished and unfinished gasoline stocks on last September 21 represented a gain of 25,139,000 bbl. over the corresponding date the year before. By January 4 of this year, the increase over the previous year had dropped to 17,796,000 bbl. On February 8 the difference was 12,277,000 bbl. A casual glance at these figures seems to show improvement amounting to 12,862,000 bbl. This is not the case.

It is true that September 1956 was an unusual gasoline month. Normally, gasoline stocks drop a million or two barrels during the month. But, the total increased a little more than 5 million barrels last September. Part of the apparent correction in the last quarter was due to the fact that stocks had moved up sharply during the last quarter of 1955.

The same thing clouded the picture since the first of the year. Gasoline inventories climbed 18,472,000 bbl. in January 1956 and 12,187,000 bbl. in February. The gasoline-inventory level is moving closer to stocks on the same date last year. But, the gap closing has been due more to rapid gains last year than to cuts this year.

The illusion is analogous to a situation in driving a car. You pull up to a stop light beside another car and look across at the driver of that car. If he lets his car roll forward you get the feeling that your car is rolling backward. The relative movements of this year's and last year's stocks may be just as misleading.

For an accurate comparison of stock positions, the observer needs to know the current rate of change, the rate last year, the relative stock position last year, and something of the probable demand over the coming months.

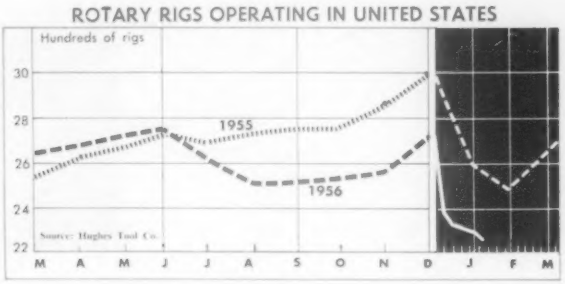
For the past 6 weeks, gasoline stocks have been increasing at the rate of 2,290,000 bbl. per week. The total gain for January is estimated at about 10,400,000 bbl.

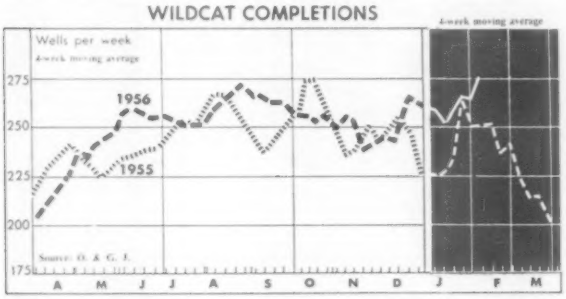
Stocks jumped 18,472,000 bbl. during January 1956. The average January increase for the 6-year period ending with 1956 was 13,700,000 bbl. These figures show that the gain this year was smaller than the average for the past 6 years and much smaller than for 1956. But, the abnormal gain in January last year was a factor in the big stock accumulation that made drastic measures necessary this winter.

Over the past few years there have been two major periods of unusual additions to gasoline stocks. The first started in the last half of 1953 and extended through most of the first half of 1954. Good demand and restricted production held stocks for the first 9 months of 1955 to 1954 levels or below.

Another big period of gain started in 1956. Even with increased demand, gasoline stocks throughout 1957 need to be no higher than in 1956. Since current stocks are 12,277,000 bbl. above last year, operations should be adjusted to give smaller weekly additions than last year for the rest of the first quarter. Second-quarter reductions should be larger than in 1956.

End-of-March stocks will be between 205,000,000 and 210,000,000 bbl.





ACTIVE ROTARY RIGS*

Area—	2-11-57	2-4-57	2-13-56
North Central and East	53	71	79
Southeast	26	32	31
Okla., Kans., Ark., Mo.	373	375	444
Louisiana	451	440	394
North and East Texas-Panhandle	346	349	376
Gulf and South Texas	212	213	264
West Texas-New Mexico	492	478	483
Rocky Mountain	191	198	197
Pacific Coast	106	108	127
Total United States	2,250	2,264	2,395
Western Canada	244	238	224

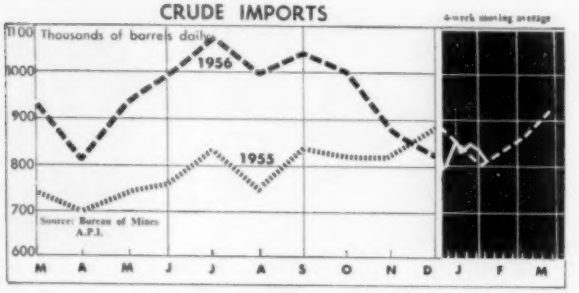
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED FEBRUARY 9, 1957

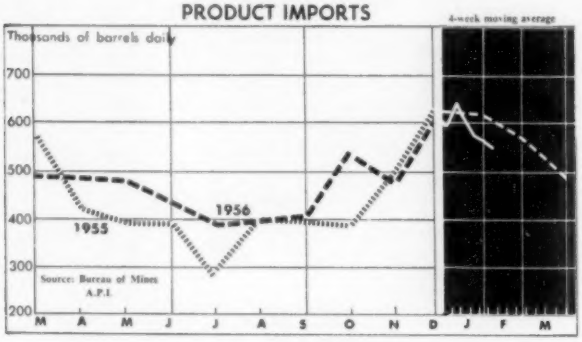
	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1957				
	Comp.	Oil	Gas	Dry	Footage	1957	1956	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	2	1	0	*1	16,112	4	15	0	0	0	1	1	0	0	0	3	3
Arkansas	22	16	0	6	58,349	144	83	0	0	0	4	4	3	0	0	17	20
California	46	33	1	†12	153,705	251	237	0	0	1	9	10	4	0	2	61	67
Colorado	24	5	0	19	118,896	146	140	1	0	0	13	14	5	0	1	94	100
Illinois	43	22	0	21	100,591	292	500	1	0	0	7	8	3	0	0	70	73
Indiana	15	3	1	†11	27,474	82	84	0	0	0	1	1	3	0	0	9	12
Kansas	79	45	10	†24	291,605	478	520	3	0	1	4	8	13	0	3	76	92
Kentucky	23	12	3	8	43,170	186	227	0	0	0	0	0	7	0	1	31	39
Louisiana	77	40	13	24	593,828	440	506	3	0	4	14	21	12	4	13	53	82
North	29	17	2	10	102,630	190	202	1	0	0	6	7	2	0	1	19	22
South	36	16	8	12	372,281	188	249	1	0	3	7	11	6	4	11	31	52
Offshore	12	7	3	2	118,917	62	55	1	0	1	1	3	4	0	1	3	8
Michigan	2	2	0	0	7,774	42	62	0	0	0	0	0	1	0	0	17	18
Mississippi	6	3	0	3	34,572	29	57	0	0	0	3	3	2	0	0	11	13
Montana	3	3	0	0	15,990	43	49	0	0	0	0	0	1	0	0	15	16
Nebraska	17	4	0	13	100,491	91	101	1	0	0	6	7	5	0	0	49	54
New Mexico	26	15	3	8	146,416	237	244	1	0	0	6	7	9	0	3	26	38
Northwest	6	1	3	2	18,784	89	86	0	0	0	2	2	4	0	2	8	14
Southeast	20	14	0	6	127,632	148	158	1	0	0	4	5	5	0	1	18	24
North Dakota	4	3	0	1	36,297	32	25	0	0	0	1	1	2	0	0	9	11
Ohio	9	3	3	†3	15,395	108	136	0	0	0	0	0	0	0	0	2	2
Oklahoma	137	88	3	46	430,437	828	1,083	2	1	0	10	13	15	3	0	81	99
Pennsylvania-New York	17	0	8	9	91,846	39	75	0	0	0	8	8	0	0	2	11	13
Texas	570	357	23	190	2,302,806	2,648	2,479	20	0	3	131	154	94	4	28	661	787
Southwest (1 & 4)	69	38	5	26	249,550	310	359	3	0	0	19	22	10	2	11	107	130
Gulf Coast (2 & 3)	50	20	9	21	333,436	304	338	2	0	3	18	23	9	0	14	90	113
East (5 & 6)	45	24	4	17	245,235	165	136	0	0	0	10	10	3	0	0	46	49
N. Central (7-B & 9)	211	109	0	102	579,624	980	869	8	0	0	72	80	48	0	2	298	348
West (7-C & 8)	156	136	0	20	753,907	702	635	7	0	0	11	18	22	0	1	103	126
Panhandle (10)	39	30	5	4	141,054	187	142	0	0	0	1	1	2	2	0	17	21
Utah	3	0	1	2	19,514	18	3	0	0	0	2	2	3	0	0	8	11
West Virginia	10	2	8	0	22,337	87	82	0	0	0	0	0	0	0	5	2	7
Wyoming	14	5	0	9	60,372	104	106	0	0	0	7	7	6	0	0	32	38
Miscellaneous (S. D.)	1	0	0	1	1,650	12	27	0	0	0	1	1	0	0	1	5	6
Total U. S.	**1,150**	662	77	411	4,689,627	6,341	6,841	32	1	9	228	**270**	188	11	59	1,343	1,601
Total previous week	1,073	544	79	450	4,334,982			29	1	9	225	264	156	10	50	1,115	1,331
Total Feb. 11, 1956	1,227	703	77	447	4,976,682			43	3	10	219	275	204	25	47	1,285	1,561
Cumulative 1957	6,341	3,353	449	2,539	26,041,357												

Service wells included: †1. *Incl 1 Fla. 4,612 ft.

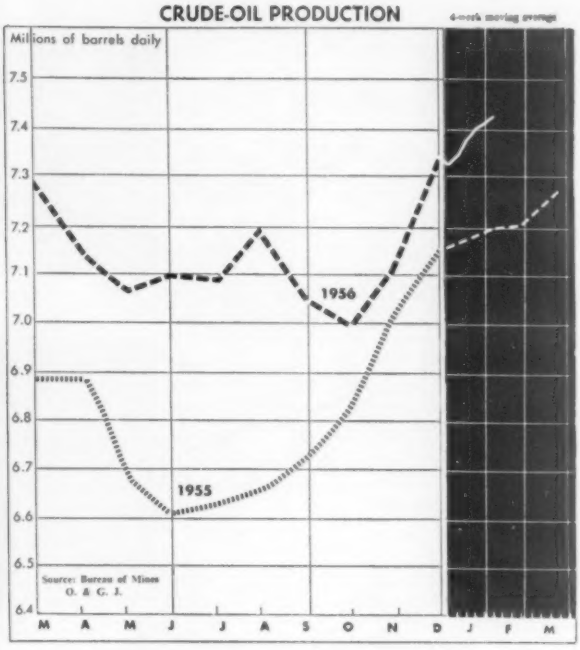
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

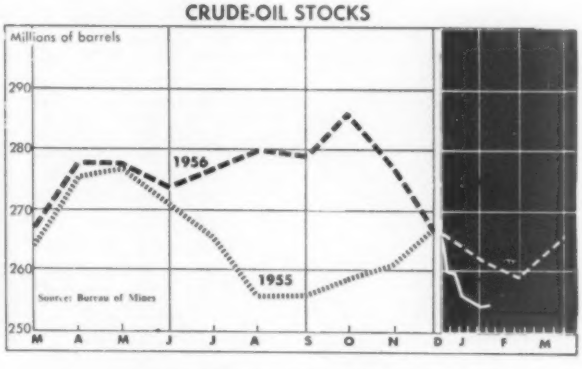


DAILY AVERAGE PRODUCTION FOR WEEK

	February 9, 1957			Feb. 2
	Crude oil	Lease condensate	Total	total
Alabama	11,300	.....	11,300	11,500
Arkansas	80,500	450	80,950	81,050
California	939,400	.....	939,400	942,500
Colorado	160,250	.....	160,250	160,500
Eastern	49,900	.....	49,900	50,800
Florida	1,250	.....	1,250	1,300
Illinois	232,300	.....	232,300	230,400
Indiana	32,000	.....	32,000	32,300
Kansas	†343,250	.....	†343,250	†335,600
Kentucky	48,900	.....	48,900	48,000
Louisiana	897,050	77,950	975,000	980,200
North	126,050	2,950	129,000	132,200
South	771,000	75,000	846,000	848,000
Michigan	26,700	.....	26,700	26,300
Mississippi	107,550	5,200	112,750	113,825
Montana	69,850	.....	69,850	69,200
Nebraska	38,650	.....	38,650	38,650
Nevada	100	.....	100	100
New Mexico	253,300	4,975	258,275	250,780
North Dakota	40,200	.....	40,200	41,450
Oklahoma	†591,000	.....	†591,000	†618,050
Texas	3,074,000	56,350	3,130,350	3,079,150
Dist. 1	56,000	525	56,525	56,075
Dist. 2	152,000	8,950	160,950	154,250
Dist. 3	432,000	26,500	458,500	458,500
Dist. 4	238,000	6,500	244,500	236,700
Dist. 5	42,000	500	42,500	40,050
Dist. 6	138,000	6,350	144,350	136,300
East Texas field	214,000	.....	214,000	207,000
Dist. 7-B	165,000	100	165,100	162,075
Dist. 7-C	171,000	4,400	175,400	172,600
Dist. 8	1,156,000	1,425	1,157,425	1,144,450
Dist. 9	212,000	825	212,825	209,805
Dist. 10	98,000	275	98,275	101,300
Utah	11,700	.....	11,700	9,950
Wyoming	300,100	.....	300,100	302,400
Others	‡100	.....	‡100	‡100
Total U. S.	7,309,350	144,925	**7,454,275**	7,424,105
Change from prev. week, up			**30,170**	
Canada	†486,300	.....	†486,300	†530,400
Total U. S. prod., January 1-February 9				296,728,870 bbl.
Same period last year (crude plus cond.)				*287,475,720 bbl.

*Includes 5,044,220 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

CRUDE-OIL STOCKS

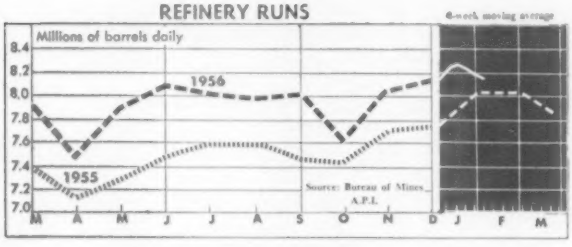


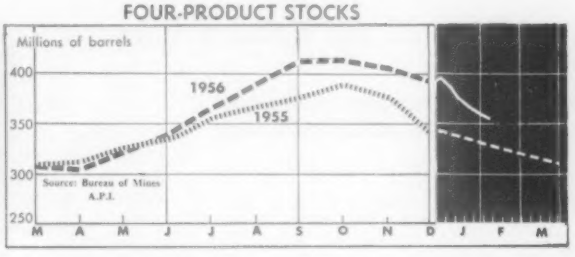
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

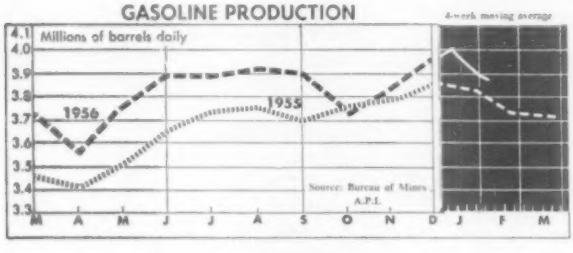
(Thousands of barrels)

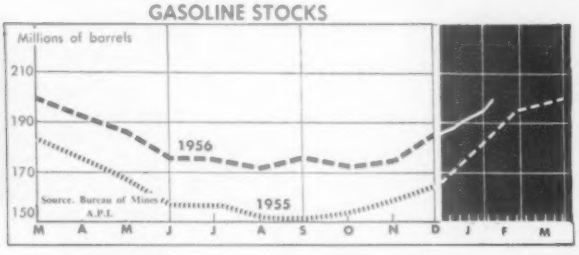
	2-2-57	1-26-57	2-4-56
Pennsylvania Grade	2,362	2,335	2,657
Other Appalachian	2,258	2,250	2,172
Illinois, Indiana, Michigan	10,123	10,888	9,362
Nebraska, North Dakota	2,186	1,965	2,280
Kansas	9,677	9,633	7,819
Oklahoma	21,428	21,529	21,599
Arkansas	2,915	2,821	2,177
Louisiana	18,777	18,647	16,370
North	2,849	2,837	2,662
South	15,928	15,810	13,708
Mississippi	2,688	2,807	3,047
New Mexico	7,954	7,815	7,774
Texas	111,966	113,403	123,490
East Texas proper	9,235	8,885	9,145
West Texas	52,701	53,565	58,890
Texas Gulf	21,575	21,200	24,514
Other Texas	28,455	29,753	30,941
Wyoming	16,261	16,036	15,590
Other Rocky Mountain	5,983	5,878	5,670
California	27,484	27,396	27,763
Foreign	†11,929	10,787	10,440
Total	253,991	254,190	258,210

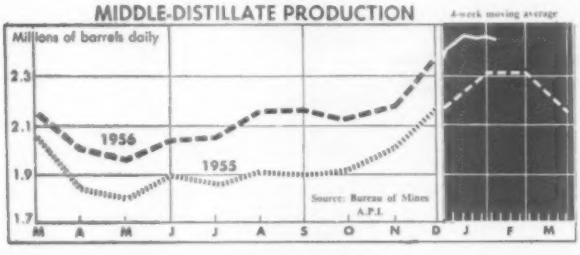
*Bureau of Mines. †Includes 2,735,000 bbl. in California.

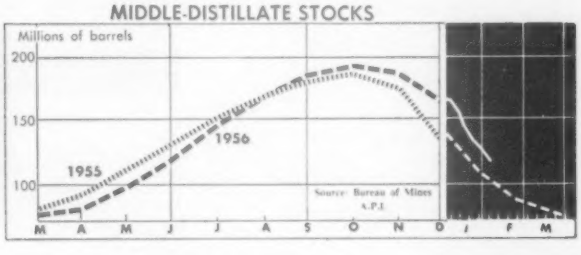


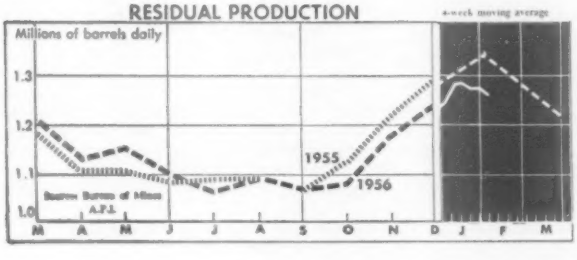


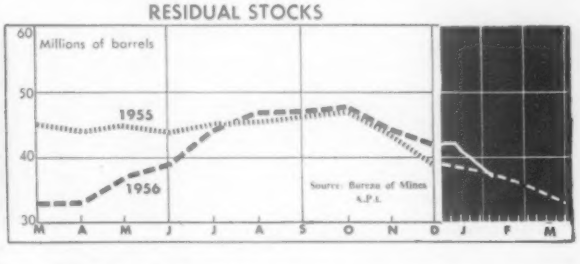












A.P.I. REFINERY REPORT, FEBRUARY 8, 1957

(Thousands of barrels)

District—	Daily avg. runs	Daily average production: Gaso.*	Kero.	Dist.	Resid.	Stocks‡: Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, February 1956: Daily avg. runs	Daily average production: Gaso.*	Kero.	Dist.	Resid.
East Coast	1,211	496.9	43.3	340.1	203.6	40,811	10,553	33,816	8,782	1,116	463.4	42.3	304.3	239.6
Appalachian:														
District 1	99	39.3	5.4	25.0	6.3	5,003	473	2,327	381	99	39.7	4.8	25.6	9.3
District 2	111	59.6	6.9	19.1	17.1	3,051	404	751	298	107	52.5	7.0	21.2	15.1
Ind., Ill., Ky.	1,384	733.6	57.7	339.8	200.3	36,780	4,403	13,752	4,505	1,423	710.5	78.5	302.8	199.2
Minn., Wis., Dak.	100	49.1	6.3	26.6	7.0	7,066	786	5,113	236	92	43.4	11.9	17.0	9.2
Okla., Kans., Mo.	703	418.4	14.4	175.3	46.4	19,505	1,024	9,139	1,103	715	399.4	15.8	188.3	41.4
Inland Texas	278	197.0	12.9	55.5	19.4	8,535	384	1,638	1,820	275	182.7	9.7	50.5	28.3
Texas Gulf Coast	1,998	910.3	135.4	547.8	262.2	28,484	2,436	7,924	5,928	2,025	888.9	138.9	553.1	258.4
La. Gulf Coast	715	322.4	63.3	210.0	49.9	12,360	1,463	4,445	1,586	692	325.0	55.2	204.8	63.5
N. La. and Ark.	103	39.0	11.6	28.0	7.4	5,302	1,038	2,091	206	95	36.4	9.3	20.6	5.8
Rocky Mountain:														
New Mexico	27	13.3	0.4	4.3	3.3	488	10	92	63	21	11.8	0.4	3.2	3.1
Other Rocky Mtn.	291	138.4	2.6	69.8	39.0	7,158	295	2,351	911	278	130.1	4.2	66.0	44.2
California	1,099	495.0	13.1	171.0	408.7	25,352	345	10,077	11,223	1,109	461.5	7.0	160.6	368.8
Feb. 8, 1957	8,119	3,912.3	373.3	2,012.3	1,270.6	199,895	23,614	93,516	37,042	8,047	3,745.3	385.0	1,918.0	1,285.9
Feb. 1, 1957	8,202	3,880.3	403.6	2,087.9	1,241.0	196,351	24,622	100,369	38,202	.....	.....	.....	.....	.....
Feb. 10, 1956	8,616	3,699.8	370.6	1,919.6	1,310.1	187,618	20,069	80,569	37,727	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (88 octane)	12.00-12.25
Premium (96 octane)	13.75-14.00
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	11.25-11.50
Regular (92 octane)	11.50-11.75
Premium (97 octane)	13.25-13.50
Premium (98 octane)	13.50-14.00
California (rack):	
Regular (84 octane)	13.1
Premium (93 octane)	14.1
Premium (96 octane)	15.1
Caribbean area (cargoes):	
Regular (87 octane)	11.00
Premium (93 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	5.0
Breckenridge:	
Grade 26-70	4.5

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	10.625-10.75
Diesel oil (58 d.i. and above)	10.25-10.50
Distillate No. 1	10.25-10.50
Distillate No. 2	9.625-9.75
Gulf Coast (cargoes):	
Kerosine 41-43	10.75-11.25
Distillate No. 2	10.25-10.75
New York Harbor (barges):	
Kerosine 41-43	12.25
Distillate No. 2	11.65
Diesel fuel, 48-52 d.i.	11.95
Caribbean area (cargoes):	
Distillate No. 2	10.25

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude scale (solid in bags or barrels	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$2.45-2.70
Gulf Coast (cargoes):	
Bunker C fuel	$2.75-3.25
New York Harbor (barges):	
Bunker C fuel	$3.30-3.40
Caribbean (cargoes):	
Bunker C	$2.55
California (rack):	
Bunker C fuel, Los Angeles	$2.75-3.00

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	25.5
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	22.25
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	28
200 vis. neutral (180 at 100°), 25 p.t.	26

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	★Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.67	....	....	....	....
15-15.9	2.71	....	....	....	$1.89
16-16.9	2.74	....	....	....	1.94
17-17.9	2.78	....	....	....	1.99
18-18.9	2.82	....	....	....	2.04
19-19.9	2.85	....	....	....	2.09
20-20.9	2.89	$2.75	....	$2.62	2.14
21-21.9	2.93	2.77	....	2.64	2.19
22-22.9	2.97	2.79	....	2.66	2.24
23-23.9	3.01	2.81	$3.44	2.68	2.29
24-24.9	3.05	2.83	3.46	2.70	2.34
25-25.9	3.09	2.85	3.48	2.72	2.39
26-26.9	3.13	2.87	3.50	2.74	2.44
27-27.9	3.17	2.89	3.52	2.76	2.49
28-28.9	3.22	2.91	3.54	2.78	2.54
29-29.9	3.27	2.93	3.56	2.80	2.59
30-30.9	3.32	2.95	....	2.82	2.63
31-31.9	3.38	2.97	....	2.84	2.67
32-32.9	3.44	2.99	....	2.86	2.71
33-33.9	3.50	3.01	....	2.88	2.75
34-34.9	3.56	3.03	....	2.90	2.79
35-35.9	3.61	3.05	....	2.92	2.83
36-36.9	3.65	3.07	....	2.94	2.87
37-37.9	3.68	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40 and up	....	3.15	....	3.02	2.95

*Includes Oklahoma, most of Kansas, North Dakota, West Texas (sweet) and North Central Texas. †Low Cold test Gulf Coast. ‡Sour.

Effective dates: California January 17, 1957, east of California, January 3-January 10, 1957; Pennsylvania Grade, January 16, 1957.

Some crudes in North Central Texas and West Central Texas, are on the intermediate schedules.

FLAT PRICES

Louisiana:	
Bienville (distillate)	$3.05
Ville Platte	3.45
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.88
Middle District	4.70
Southwest Pennsylvania	4.41
West Virginia	4.23
Buckeye Grade	4.23
Zanesville Grade	3.27
Illinois Basin	**3.15**
Canada:	
Leduc-Woodbend (flat prices D-2), D-3)	2.78
Redwater (Alta.) D-3	2.67
Smiley-Viking (Sask.)	2.44
Pembina	2.65

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 40°-40.9°, Puerto La Cruz	3.37
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26.5°-26.9°, Amuay*	2.55
Quiriquire, 16.5°-16.9°, Caripito	2.45
Lagunillas heavy, flat, Amuay or Las Piedras*	2.38
Bachaquero, flat, Las Piedras*	2.23

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.87
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.69
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

Gulf-U.S.N.H., clean (USMC+175%)	$7.84
Gulf-U.S.N.H., dirty (USMC +167.5%)	7.62
★ N.W.I.-U.S.N.H., dirty (USMC +172.5%)	7.36
★ Gulf-France, clean (USMC+185%)	21.80
P.G.-France, dirty (Scale+340%) (354s. 7d.)	49.61

SUPPLY AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

GASOLINE

	Total demand	Refinery production	Stocks end of period†
January 1957*	3,680	3,904	195,910
December 1956*	3,643	3,954	186,000
November 1956	3,862	3,859	174,808
February 1956	3,440	3,745	196,092
January 1956	3,335	3,843	183,905

KEROSINE

January 1957*	595	376	24,760
December 1956*	474	381	31,000
November 1956	434	384	34,329
February 1956	481	385	18,712
January 1956	569	385	21,310

DISTILLATE

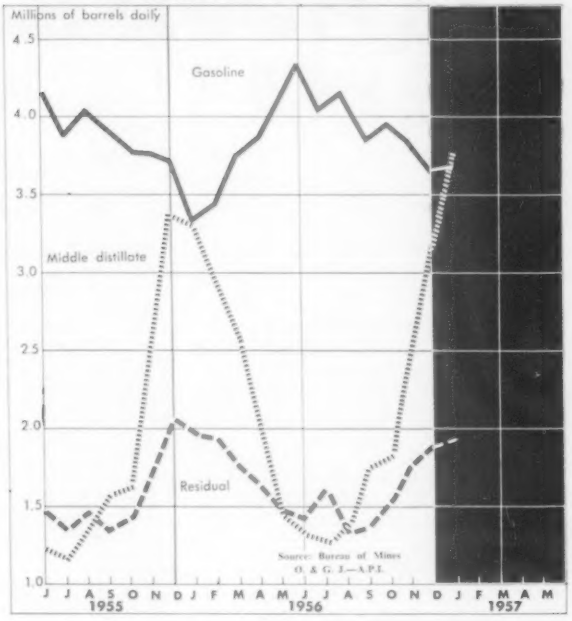
January 1957*	3,160	2,076	101,240
December 1956*	2,620	1,985	131,000
November 1956	2,105	1,841	151,517
February 1956	2,450	1,918	71,335
January 1956	2,755	1,923	86,141

RESIDUAL

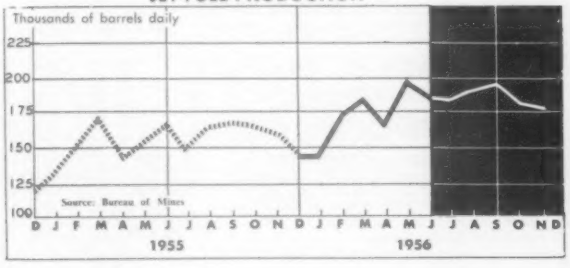
January 1957*	1,950	1,270	38,400
December 1956*	1,875	1,240	42,500
November 1956	1,769	1,182	44,590
February 1956	1,932	1,286	35,673
January 1956	1,980	1,344	38,247

*Preliminary. †Thousands of barrels.

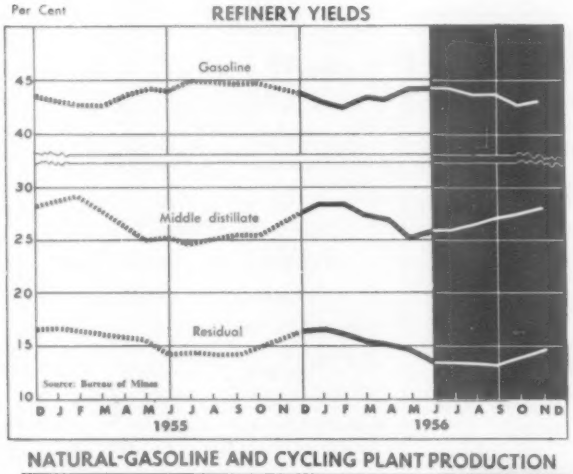
TOTAL DEMAND—MAJOR PRODUCTS



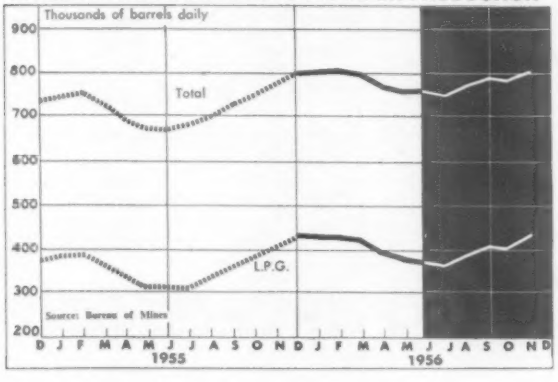
JET-FUEL PRODUCTION



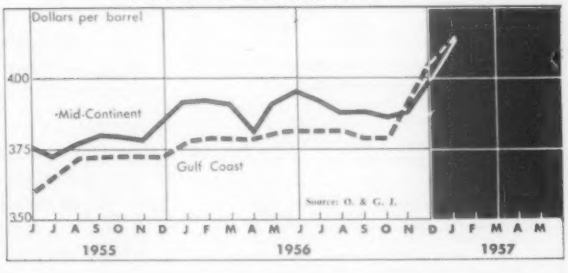
REFINERY YIELDS



NATURAL-GASOLINE AND CYCLING PLANT PRODUCTION



REFINERY REALIZATION



REFINERY REALIZATION

	Jan.* 1957	Dec.* 1956	Nov. 1956	Jan. 1956
Mid-Continent	$4.14	$3.98	$3.88	$3.92
Gulf Coast	4.15	4.03	3.89	3.77

*Preliminary.

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel oil, and residual as published in The Oil and Gas Journal.

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Petro. Industries Consultants, C.A. Caracas, Venez.

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1955 MODEL 1000 Mayhew Combination Air and Water Drilling Rigs. Also 315 cfm Schramm Diesel Air Compressors. V. M. Shortes, Box 127, Lovington, New Mexico. Phones 6-7591 or 8533.

COMPRESSOR CYLINDERS: 3 Ingersoll-Rand 6" x 12", excellent condition, price $1,000 each, location Southwest Texas. Address Slick Secondary Recovery Corporation, Milam Building, San Antonio 5.

FOR SALE EQUIPMENT

BESSEMER GAS COMPRESSORS—3 type 10 twins direct connected units—Boswell-Frates Company, 1003 Kennedy Building, Tulsa, Oklahoma.

FOR SALE—Cardwell Spudder. RL502, complete with tools, equipment necessary for efficient operation. Price, inventory on request. K & A Drilling Co., Phone 448R, Box 497, Ellinwood, Kansas.

8000' 4½" 10.79 lbs., lap weld line pipe, 40' random lengths, good body, clean inside and out, straight, beveled, ready to lay 65c. M. J. Regan Pipe Co., Coffeyville, Kans.

FOR SALE

143 Jts. 21.90# Grade D Youngstown API IUE R-2 Seamless Drill Pipe (New), complete with 143 7" OD x 4" ID Hughes API Full Hole Counter Bore Welded Tool Joints.

120 Joints 21.90# Grade D National Tube—Same description as above, also new.

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Attn.: MR. J. R. WILSON, JR.,
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1—5' x 96' tower, 40 tray, 135# WP.
1—2' x 50' tower, 24 trays.
1—Ethyl lead plant.
2—Convection furnaces, 20 MIL BTU/hr.
8—Welded storage tanks, 5,000, 2,000 bbl.
8—Hi-vol pumps, 10 x 7 x 18, 10 x 6 x 12, 6 x 4 x 12, 6 x 3 x 8.
Large Selection of Series 15, 30 Steel Valves, 1" to 8"

VESSELS

2—12' x 45' Butane Tanks, 125#
2—12' x 45' Storage Tanks, 25#
1—14' x 21' Clay Tower, 125#
1—8' x 75' Tower, 20 Trays, 25#
1—18" x 32' Tower, 15 Trays, 160#
2—8½' x 25' Tanks 50#

HOT-OIL PUMPS

3 Pacific ITB, 400 gpm—2,000' hd, 735 gpm—3,100' hd.
5 Pacific SVTB, 612 gpm—600' hd, 324 gpm—480' hd, 308 gpm—516' hd, 193 gpm—389' hd.
1 Pacific HVTB (unused) 1270 GPM—408' Hd.
BJ hot oil pump 3 x 9, 13 st, 325 gpm, 4600' hd.

IN STOCK

HEAT EXCHANGERS

3—Kellogg Adm. Ftg. Hd. 2200, 1800 Sq. Ft., 315#
4—Kellogg Stel Ftg. Hed. 800, 650, 500 Sq. Ft.
18—GR Fin Tubes, 73 Sq. Ft.
6—Brown fintube exchangers, 300# 140 Sq. Ft. 4-6 chrome.
6—Adm. 785, 742, 425 Sq. Ft.
30—304 SS shell & tube condensers 100-1000 Sq. Ft.

COMPRESSORS

1 Worth LTC-6 800 hp.
2 Clark RA-5 500 hp.
3 Penn Comps 100 CFM 500 lbs.
385 CFM 160 lbs.

MISCELLANEOUS

6—Bird Centrifugals 32 x 50, 24 x 38, 18 x 28.
5—Sweetland Filters No. 12, No. 10, No. 7, No. 5.
4—Rotary Vac. Filters, 10 x 12, 8 x 10, 5 x 8.
Lab Petro-Chem furnace 50,000 BTU/hr.
9—3' x 10' 410 SS Sheets.
Tremendous selection stainless steel and steel valves 1½"-6".
Goulds 16" pump, 10,500 gpm, 135' hd.

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New & Used Casing, Tubing & Line Pipe

Immediate Delivery

20,000'—4½" O.D. 9.50# 8rd thd New CW casing 1800# Test R-1 & 2
3,300'—2⅞" O.D. 6.40# 11½ V thd Used Grade "C" Smls Tubing R-2
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30,000'—3½" O.D. 8.70# 11½ V thd Used L.W. Tubing R-1
3,300'—5½" 17# 10 V thd Grade "C" Smls Casing R-2
10,000'—7" O.D. 20 and 24# 10 V thd L.W. Casing R-1
2,880'—6⅝" O.D. 18.97# API 5-L E.W. New Line Pipe S.R. Lengths
2,350'—8⅝" O.D. 24.70# API 5-L E.W. New Line Pipe S.R. and D.R. Lengths
332'—10¾" O.D. 31.20# API 5-L E.W. New Line Pipe S.R. Lengths
537'—12¾" O.D. 43.77# API 5-L E.W. New Line Pipe S.R. Lengths
500 Sets 5½" O.D. New S.R. Dresser Style 38 Couplings with 5" Middle Rings and plain grade gaskets. Also mill carload quantities new C.W. and Butweld pipe. Prompt delivery.

The Sandy Supply Company
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FOR SALE—1 Clark Brothers Engine Driven Compressor, 16 x 20, 180 R.P.M., 80 H.P., Serial #431 with one 7½ x 14 x 20 Compressor Cylinder, Type Q, Serial #5201 and one 14 x 20 Compressor Cylinder, Serial #5208. Completely assembled as one unit. Box J-925, The Oil and Gas Journal, Tulsa, Oklahoma.

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70,000'—4" Used Line Pipe, 10.79 Lb., Drl., PE., Cleaned, Ready to Lay.
52c per foot.

32,000'—6" Used Line Pipe, 18.97 Lb., Drl., PE., Cleaned, Ready to lay.
$1.10 per foot.

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EXTERNAL UPSET TUBING

Brand new E.W. range 2 prime, tested, 3500 PSI with API couplings and threads delivered in carload lots only at low price or will trade for other size of new pipe and casing. For price or placement of orders phone or wire collect.

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1200'—13⅜" OD 54# 8 Rd. Thrd. J-55, Range 2, Seamless Casing
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3000'—7" OD 20# 8 Rd. Thrd. J-55, Range 2, Seamless Casing
(The above is #1 used cable tool pipe located in Kansas.)
3750'—New 5½" OD 14# 8 Rd. Thrd. J-55, Range 2, Steel Casing.
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SALES AND RENTALS. Used cable drilling and fishing tools, casing, production equipment; from the Southwest's largest stock of oil field supplies. Degen Pipe and Supply Co., Tulsa.

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1951 Model Wilson Giant, 8000' capacity. Includes: Two (2) sets of 671 G. M. Diesel Motors Compounded 300 HP Transmission. 7¾" x 16" Gardner-Denver Pump. 17½" Oil Well Oil Bath Rotary Table. 126' Lee C. Moore Mast. Six 5¾" x 39' Drill Collars. Everything in excellent working condition. Full inventory available on request.

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COMPLETE UNITS

Houdriflow Catalytic CRACKING UNIT 8800 bbl./day. (new 1952)

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POLYMERIZATION UNIT 400 bbl./10#/day

ETHYL BLENDING PLANT 8500 gal. Complete SKIMMING POND

110,000 gal. FOAMITE SYSTEM—complete

VALVE TESTING UNIT Ing. Rand 41X5
TELEMATIC 48 TANK GAUGING SYSTEM

50,000#/hr. COCHRANE WATER TREATING and Deaerating Plant

2—28 Spot CAR LOADING RACKS, capable 10 products each spot

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500—New Croloy #5, 3" to 6⅝" OD 15 to 32' long

500—4", 4-6% Chrome, headers

200—4½", 4-6% Chrome, headers

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8'x32'3" ACCUMULATOR, 135 PSI @ 650° F.

6'x40' SOAKER, 500 PSI @ 850° F.

20'x28'4" AGITATOR, cone bottom

10,000 bbl. HORTONSPHERE

6500 gal. PROPANE TANK

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8'x34'6"x½" 10 trays

6'x30'x½" 9 trays

5'x58'x⅜" 26 trays

4'6"x30'5"x⅜" 14 trays

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HOT OIL 334 GPM, 1,000 PSI (2)
FIRE 2500 GPM at 426' head
CENTRIFUGAL from 60 to 1500 gal. from 40 to 655' head.
STEAM—Hot Oil—Simplex—Duplex
PROPORTIONING—1 to 5 HP

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HEAT EXCHANGERS—196-3100 sq. ft. (25)
NEW STEEL STACKS—240'
53—STORAGE TANKS 1,000-100,000 bbl.
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10 Ton OVERHEAD TRAVELING CRANE
PIPE—VALVES & FITTINGS—MACHINE TOOLS—WELDERS—HYDRAULIC JACKS—WAREHOUSE SUPPLIES—HAND TOOLS—LABORATORY EQUIPMENT—CHEMICALS—TRANSFORMERS—GENERATORS—ETC.

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DRUMRIGHT OFFICE—P. O. Box 587, Drumright, Okla. Phone 569

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SALESMAN TO SELL oilfield specialties in North Texas area. Excellent opportunity for aggressive salesman. Salary and commission. Advise age, experience and if presently employed. All replies confidential. Box J-916, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

MANUFACTURERS representative for North Texas to sell established line of pumping specialties. Give age, experience and number of years in territory, also lines now being handled. All replies confidential. Box J-917, The Oil and Gas Journal, Tulsa, Oklahoma.

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RECENT GRADUATE in Chemical Engineering. Position with independent oil company offers excellent opportunities for advancement and varied experience in gasoline plant operations. Prefer married man under 30. Send details of education, experience, personal background, and salary requirements to P. O. Box 3053, Dallas, Texas.

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Independent Oil Company has opening for experienced, aggressive combination geologist and landman. Must have thorough understanding of geological and land matters in Mid-Continent area and be prepared to handle full exploration program. Age limit 40. This is salaried position with excellent pay. In replying, give past employment record and educational background. All replies confidential. Reply

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Young man 28 to 35 years capable of design, rating and sales of heat exchangers. Established fabricator located in S.W. City of 300,000.

Reply stating full particulars as to education, employment background and qualifications.

Salary commensurate with experience and ability. All replies kept confidential. Reply to

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Subsidiary operating in Venezuela has opportunities for engineers with/without experience. Salary commensurate with experience.

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DESIGNERS
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Seeking a man with a degree in chemical engineering or in chemistry having a strong mathematical interest with at least three years experience in the petroleum or petrochemical field or a man with a degree in mathematics with chemical engineering training for work on petroleum or petrochemical problems utilizing a wide range of mathematical background in the operations research field. Experience desired three to ten years. Mid-West location. Reply

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ENGINEER

OIL REFINERY OPERATIONS
SANTOS, BRAZIL

Acceptable applicant must have:

1. **Accredited engineering degree, preferably chemical engineer.**
2. **Minimum 4 years experience oil refinery process engineering,**

and be qualified to specify changes in those control operations required to modify quality & quantity of end products. Preferred, but not mandatory, that applicant have experience as advisor of oil refinery management on process operations.

Salary commensurate with experience. Living allowance in Brazilian currency and round trip air transportation provided for applicant and family. Minimum one year assignment.

Mail complete chronological resume, including education and employment (names and addresses of employers, salaries, dates employed, positions held, scope of responsibility and title of immediate superior), to Personnel Department.

HYDROCARBON RESEARCH, INC.

115 BROADWAY NEW YORK 6, N. Y.

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PROCESS ENGINEER with thorough technical training and minimum background of eight years refining and hydrocarbon processing experience with special emphasis on catalytic reforming and petrochemicals. Send complete record of education, experience, and minimum salary expected. Write Box J-867, The Oil and Gas Journal, Tulsa, Oklahoma.

MAJOR PIPE LINE Company located in Western Canada requires experienced corrosion engineer. Applicant should be fully conversant with and experienced in corrosion mitigation and be capable of organizing, directing and maintaining a corrosion mitigation program. Position offers excellent benefit plans. Please reply to Box J-944, The Oil and Gas Journal, Tulsa, Oklahoma, furnishing resume of experience and stating salary expected.

LOUISIANA ATTORNEY. Independent producing company needs attorney in home office located in Shreveport. Applicant should have 2 to 5 years experience in oil and gas law. Placid Oil Company, Shreveport, Louisiana.

Pipe Line Engineers

Career Opportunities for Graduate Engineers experienced in estimating-economic analysis or design of oil and gas pipe lines. Openings in the United States and abroad.

All communications strictly confidential.

Pipe Line Technologists, Inc.

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Phone JA 6-1221

REFINERY TECHNOLOGIST

If you are a Chemical Engineer with 3 to 5 years experience in refinery process engineering or operation and economic analysis and have an interest in consulting and technical service type work, you should investigate this unique opportunity to capitalize on your background and to participate in the growth of an expanding technical activity of a well known company allied to the refining industry. This position offers a wide variety of assignments, industry-wide contacts with refining and process companies, for using initiative and originality to increase responsibility. A midwest suburban location offers ideal professional environment. Send resume of qualifications to

Box J-891,
The Oil and Gas Journal,
Tulsa, Oklahoma.

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CHEMICAL ENGINEER OR PETROLEUM ENGINEER to direct product research and development on oil and gas field equipment. Engineer should have several years' experience in natural gas or petroleum processing and possess a good background in thermodynamics.

This important position offers excellent opportunity for professional advancement for an ambitious, creative engineer.

Please send complete information and photograph to:

Orval W. Groves,
Employment Supervisor

BUTLER MANUFACTURING COMPANY

7400 East 13th Street
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HELP WANTED

FOREIGN EMPLOYMENT. List oil companies, drilling contractors, seismograph contractors, showing where apply foreign jobs. $5.00 cash. OIML Co., Box 2603, Tulsa, Okla.

PETROLEUM ENGINEER with Master's Degree, or Doctor's in Chemical, Mechanical, or Petroleum Engineering for research and teaching in Petroleum Production Engineering at rapidly growing southwestern institution. Rank and salary open, twelve months employment possible, consulting work encouraged and available in immediate area. Applications will be kept confidential. Box J-902, The Oil and Gas Journal, Tulsa, Oklahoma.

MECHANICAL ENGINEER for Major Oil Company in Mid-Continent area. Must be graduate engineer and have six to ten years supervisory and master planning experience in Refinery Mechanical and Maintenance Department. Address all replies giving age, education, resume of experience and salary expected to Box J-946, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

LANDMAN-LAWYER: Five years land title experience with major and independent in gulf coast, West Texas and Rocky Mountain areas. Married, age 31. Desire land or legal position. Box J-935, The Oil and Gas Journal, Tulsa, Oklahoma.

OFFICE MANAGER with small independent. Twenty-five years experience in office management, production leases, taxes, accounting and public relations. Presently self employed. References. Prefer Tulsa area. James A. Hayden, 1500 So. Frisco, Tulsa.

PRODUCTION SUPERINTENDENT. Twenty years varied production experience, Mid-Continent. 15 years supervisory, completions and workover. Presently employed. 1802 Seneca, Enid, Oklahoma. Phone ADams 7-2195.

SUPERVISOR, TOOLPUSHER. National and foreign experience. Cable tools. Twenty-five years experience, references. Foreign work preferred. Box J-921, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST: Desires responsible position with an independent or drilling Co. in Dallas. Seven years experience, sub-surface geology, drilling production, workover in N.W. and S.E. New Mexico, West and West Central Texas. Single, free to travel. Box J-882, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED LANDMAN. Eight years all phases, excellent recommendations. Age 33. Box J-915, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER with 18 months experience in drilling and production desires position with independent in United States or Canada. Presently employed as Assistant District Engineer with large independent. Box J-941, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER - GEOLOGIST Available. Fourteen years experience both domestic and foreign. Experienced in development, production and reservoir work. Reply Box J-940, The Oil and Gas Journal, Tulsa, Oklahoma.

MECHANICAL ENGINEER, 34, presently employed seven years major oil pipe line company, also one year refinery experience, desires position in engineering or engineering sales. Box J-938, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST - GEOPHYSICIST, 19 years worldwide experience seismic reflection, refraction and gravity interpretations. Sixteen years major oil company and three years seismic contractor. Postwar service in Venezuela, Trinidad and Canada. Now located Calgary. Seeks position as geophysicist with oil company or contractor. Box J-939, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL-PETROLEUM ENGINEER: 15 years experience in oil production, including water disposal, water flooding, corrosion mitigation, scale control, dehydration, separation, and special problems. Operating and supervisory capacities. Box J-936, The Oil and Gas Journal, Tulsa, Oklahoma.

THIRTY YEARS operations, administration and regulatory experience natural gas pipelines. Registered engineer. Box J-947, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

MANUFACTURER'S REPRESENTATIVE with fifteen years experience calling on Refineries, Pipeline Companies and Chemical Plants in Texas and Louisiana, desires one or two additional lines of specialty application items. Financial statement and references are available. Specialty Sales & Service Company, 1711 Bell Avenue, Houston 3, Texas.

DISTRICT GEOLOGIST, nine years subsurface experience in Mid-Continent area. Qualified to supervise, plan and organize exploration and development program. Desires to locate in North Texas or Gulf Coast area with large independent. Box J-942, The Oil and Gas Journal, Tulsa, Oklahoma.

BUSINESS OPPORTUNITIES

WOULD LIKE to represent out of State Investors interested in buying royalties, leases or in Shallow drilling deals. For particulars write R. E. (Buck) Clement, Box 65, Norman, Oklahoma.

OIL AND GAS FINANCING. Second mortgage loans; development drilling; oil payments purchased; bank loans arranged. If you are competent and honest and have a sound property, we can help you. Resources Recovery Company, Box J-910, The Oil and Gas Journal, Tulsa, Oklahoma.

INDEPENDENT equipment dealer representing twenty-four major manufacturers, oil field and industrial, desires corporate partner with minimum of $20,000.00. Excellent returns on investment. OLive 4-7510, Houston, Texas.

FINANCIAL CONTACTS. Underwriters. Brokers, Private Finders of Capital reached. No shopping. Confidential. FREE ENTERPRISE ASSOCIATES, 817 51st St., Brooklyn, N. Y.

NATURAL GAS distribution system and franchise in Eastern Kansas town. Midwest Pipeline Service, Box 67, Overland Park, Kansas.

FINANCIAL BACKING WANTED to drill well on 320 acre lease in Hitchland oil field, Hansford County, Texas. Lease is close to 27 producing good oil wells. Is adjoined and surrounded by leases belonging to major oil companies. Wells in this field and immediate area come in for 80 to 2,400 barrels of high gravity oil per day and natural gas at 3,000,000 cfgpd to 35,000,000. Ready market for oil and gas from three pipe lines in field. Great drilling activity in this area. Will give liberal interest in first well and 320 acres for finance. Chance for fortune on investment. Box J-937, The Oil and Gas Journal, Tulsa, Oklahoma.

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Box J-943,
The Oil and Gas Journal,
Tulsa, Oklahoma.

WANTED

WANT TO PURCHASE stripper production that can be reworked and stimulated with fracturing. Box J-899, The Oil and Gas Journal, Tulsa, Oklahoma.

WILL BUY one set back volumes Oil and Gas Journal any years 1919-1929, bound or loose. Rittenhouse, 1917 Westheimer, Houston, Texas.

PRODUCTION WANTED

PRODUCTION WANTED: Leases with production, prefer West or Central Texas. Must have supporting records. Box J-918, The Oil and Gas Journal, Tulsa, Oklahoma.

WANT TO BUY—Oil Properties, settled or semi-settled production. 100 to 5,000 barrels daily in Oklahoma and Kansas. Contact Morris Sitrin, 1215 First National Building, Tulsa, Oklahoma.

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480 ACRES in Coleman County, Texas, 180 acres in cultivation. Three producing oil and gas wells, 120 acres not under lease. Located in Novis field. Will sell land and mineral rights to settle estate. Contact C. B. Sprinkles, 422 W. Kennedy Ave., Coolidge, Arizona.

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Crane County: T. M. Evans 1 University "6," 6-31-ULS Sur., 15 mi. NW Crane. IPP 140 BOPD, 36°, GOR 200, Pennsylvanian 8,212-42 ft. TD 11,800 ft.

Garza County: Neville G. Penrose, Inc., and R. S. Anderson 1 Miller "GX," 39-6-H&GN, 3 mi. SW Justiceburg. IPP 83 BOPD, 37°, Wolfcamp 3,000-66 ft. TD 3,120 ft. Also completed from San Andres. IPP 47 BOPD, 37°, 2,397-2,586 ft. New pay discovery in Rocker, South, fied.

Runnels County: Pan American Production Co. 1 Barr, J. G. Wagoner Sur. 424, 1 mi. SE Ballinger. IP 3,300 M.c.f. gas, Capps lime formations 3,536-42 ft. TD 4,657 ft. Shut-in pressure 1,353 psi.

Scurry County: American Trading & Producing Co. 1 Elmer Howell "B," 62-3-H&TC, 5 mi. NE Hermleigh. IP 386 BOPD, 20/64-in., TP 250 psi., GOR 344, 37°, Canyon pay 6,203-23 ft. TD 6,983 ft.

Yoakum County: Caroline Hunt Sands 1 Neals, 398-D-J. H. Gibson Sur., 8 mi. W Plains. IP 311 BOPD, ¼-in., TP 250 psi., GOR 200, 37°, Devonian 11,929-37 ft. TD 11,955 ft.

Shell Oil Co. 18 George Baumgart "C," 866-D-J. D. Gibson Sur., 1 mi. NE Denver City. New pay in Wasson (72) field. IP 225 BOPD, 24/64-in., TP 105 psi., GOR 327, 33°, Lower Clear Fork 7,210-7,579 ft. TD 9,009 ft.

TEXAS GULF COAST

Bastrop County: Skelly Oil Co. 1 Bell, Albert Black Sur., A-84 (2 miles west of Sayersville). IP 63 BOPD (net), $\frac{7}{8}$-in., 27.7°, 17.3 per cent water, GOR 226 cu. ft. per bbl., perforations 2,496-2,502 ft. (New field.)

Bee County: Frio Drilling Co., Inc., and Christi, Mitchell & Mitchell 1-A Hart "A," James Douglas Sur., A-19. IP 100 BOPD, 9/64-in., 30°, GOR 350 cu. ft. per bbl., perforations 4,713-17 ft. TD 5,738 ft. (New field.)

Chambers County: Humble Oil & Refining Co. 1-K State, Tract 14-E, Galveston Bay. Shut in gas well, ungaged (flowed 17.6 BCPD with ungaged volume of gas through 9/64-in. choke with pressure of 2,925 psi.), perforated 8,844-55 ft. TD 9,200 ft. (New field in Galveston Bay.)

Goliad County: Nortex Oil & Gas Corp. 1 Wilheim, G. Barrera Sur., A-2 (3 miles northeast of Goliad). IP 38,000 M.c.f. daily, open-flow potential. dry gas, SIP 1,300 psi., perforations 3,062-70 ft. TD 6,210 ft. (New field.)

Jackson County: Midhurst Oil Corp. and Ogden & White 1 Lindberg, H. W. Munson Sur. IP 42,000 M.c.f. daily, open-flow potential, GOR 125 M.c.f. per bbl., 55.6°, perforations 7,180-92 ft. TD 7,505 ft. (New field.)

Newton County: Atlantic Refining Co. 1-A Kurt, Henry Suddeth Sur., A-381 (1¼ mile north of Newton field). IP 168.02 BOPD, 9/64-in., 48°, GOR 1,459 cu. ft. per bbl., perforations 7,413-17 ft. (Yegua-Quinn sand), and (dual completion) 115.38 BOPD, 7/64-in., 50°, GOR 3,960 cu. ft. per bbl., perforations 7,561-64 ft. (Yegua-Kurth sand). TD 8,305 ft. (New field, or long extension of Newton field).

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, BUREAU OF INDIAN AFFAIRS, Jicarilla Indian Agency, Dulce, New Mexico. Notice is hereby given that approximately 124,843 acres, more or less, of Jicarilla Tribal Indian lands in 53 tracts located in Sandoval and Rio Arriba Counties in New Mexico within the Jicarilla Apache Indian Reservation, will be offered for oil and gas leasing through competitive bidding to the highest responsible bidder for a cash bonus consideration in addition to stipulated rentals and royalties through sealed bids received on or before 3:00 P. M. (MST), February 28, 1957, when bids will be opened. Each tract containing approximately 3 to 4 sections each, is offered for lease separately. Details of the lease offering, and how and where to submit bids, may be obtained from the Superintendent, Jicarilla Indian Agency, Dulce, New Mexico, upon request.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Billings, Montana. Notice is hereby given that approximately 201.19 acres of land in five parcels within the known geologic structure of CUT BANK field, Montana, and approximately 3083.74 acres of land, in eighteen parcels within the known geologic structure of KEVIN-SUNBURST field, Montana, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 10:00 a.m., M.S.T., March 28, 1957, when bids will be opened.

The following are the lands offered for sale, all in Principal Meridian Montana: CUT BANK FIELD, T. 33 N., R. 5 W.; Parcel No. 1, Sec. 32, Lot 3, containing 30.50 acres. T. 33 N., R. 6 W.; Parcel No. 2, Sec. 14, Lot 3, containing 10.69 acres. Parcel No. 3, Sec. 24, SW¼ NE¼, containing 40.00 acres. T. 35 N., R. 4 W.; Parcel No. 4, Sec. 19 E½ SE¼, containing 80.00 acres. T. 36 N., R. 5 W.; Parcel No 5, Sec. 29, NE¼ NE¼, containing 40.00 acres. KEVIN-SUNBURST FIELD, T. 34 N., R. 2 W.; Parcel No. 6, Sec. 4, Lots 3, 4, SE¼ NW¼, containing 120.17 acres. Parcel No. 7, Sec. 5, N½, containing 319.84 acres. Parcel No. 8, Sec. 6, Lots 1, 2, 3, 4, 5, 6, 7, SE¼ NW¼, NE¼ SW¼, containing 343.08 acres. T. 34 N., R. 3 W.; Parcel No. 9, Sec. 1, Lots 1, 2, containing 79.99 acres. T. 35 N, R. 2 W.; Parcel No. 10, Sec. 12, NE¼, containing 160 acres. Parcel No. 11, Sec. 18, NE¼ NE¼, containing 40.00 acres. Parcel No. 12, Sec. 19, E½ NE¼, NE¼ SE¼, containing 120.00 acres. Parcel No. 13, Sec. 19, SE¼ SW¼, containing 40.00 acres. Parcel No. 14, Sec. 20, W½ NW¼, NW¼ SW¼, containing 120.00 acres. Parcel No. 15, Sec. 20, NW¼ NE¼, containing 40.00 acres. Parcel No. 16, Sec. 31, Lots 1, 2, 3, 4, E½ W½, NE¼, W½ SE¼, containing 542.08 acres. Parcel No. 17, Sec. 32, S½ NW¼, E½ SW¼, SE¼, containing 320.00 acres. Parcel No. 18, Sec. 33, N½, S½, SW¼ SW¼, containing 200.00 acres. T. 35 N., R. 3 W.; Parcel No. 19, Sec. 4, Lots 1, 2, S½ N½, containing 238.58 acres. Parcel No. 20, Sec. 7, S½ SE¼, and Sec. 18, N½ NE¼, containing 160.00 acres. Parcel No. 21, Sec. 26, SE¼ SE¼, containing 40.00 acres. Parcel No. 22, Sec. 35, SE¼, containing 160.00 acres. T. 36 N., R. 2 W.; Parcel No. 23, Sec. 35, SE¼ SE¼, containing 40.00 acres. Details of the lease offering, how and where to submit bids, may be obtained from the Manager of the Land Office, 1245 North 29th Street, Billings, Montana. Theo E. Anhder, Manager, Land Office.

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Youngstown Sheet and Tube Company Inside Back Cover

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Billings, Montana. Notice is hereby given that approximately 899.49 acres of land within the known geologic structure of Cedar Creek Field in Montana and North Dakota will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 10:00 a.m. M.S.T., March 28, 1957 when bids will be opened. The following are the lands offered for sale: Parcel No. 1: T. 11 N., R. 58 E., P. M., Montana, Sec. 30, Lots 1, 2, 3, 4, E½ SW¼, containing 233.20 acres. Parcel No. 2: T. 5 N., R. 60 E., P. M., Montana, Sec. 10, NW¼ NW¼ S½ NW¼, SW¼ containing 280 acres. Parcel No. 3: T. 5 N., R. 61 E., P. M., Montana, Sec. 2, Lot 4, containing 48.91 acres. Parcel No. 4: T 130 N., R. 107 W., 5th P. M., North Dakota, Sec. 1, Lot 1, SE¼ NE¼ containing 79.99 acres. Parcel No. 5: T. 130 N., R. 106 W., 5th P. M., North Dakota, Sec. 21, Lots 8, 11, W½ NW¼, containing 121.64 acres. Parcel No. 6: T. 130 N., R. 106 W., 5th P. M., North Dakota, Sec. 28, SE¼ NW¼, E½ SW¼, Sec. 32, Lot 4, containing 135.75 acres. Details of the lease offering, how and where to submit bids, may be obtained from the Manager of the Land Office 1245 North 29th Street, Billings, Montana. Theo E. Anhder, Manager, Land Office.

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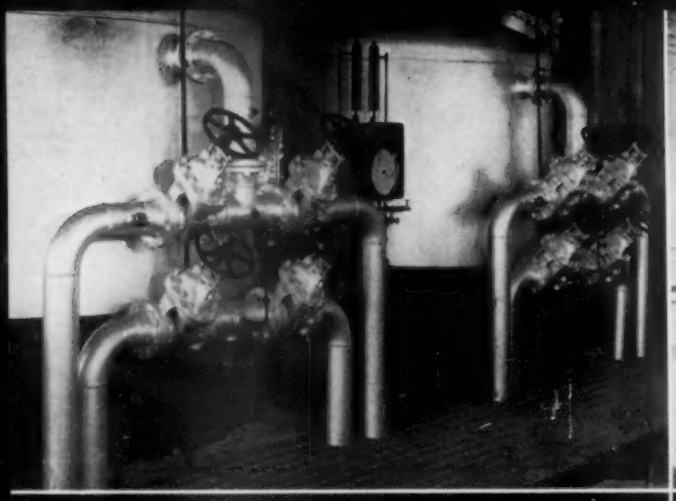

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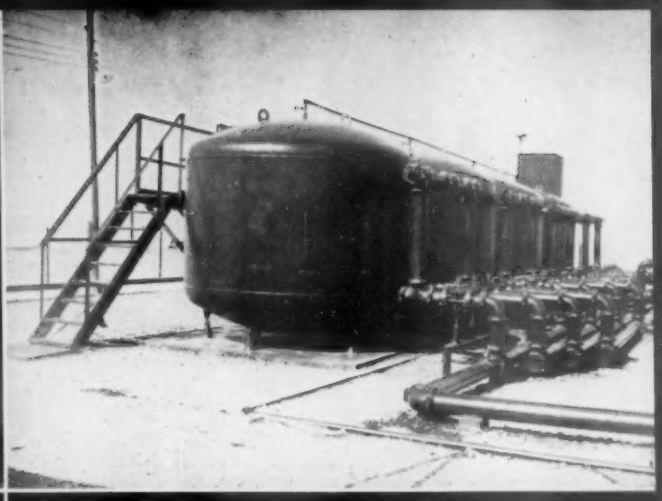

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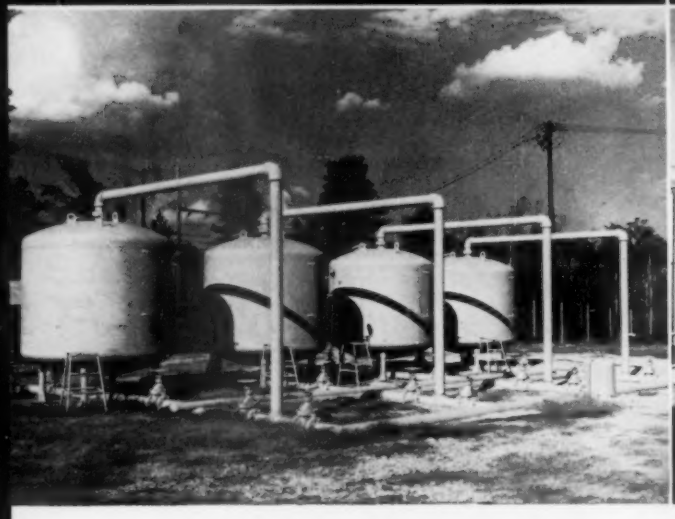

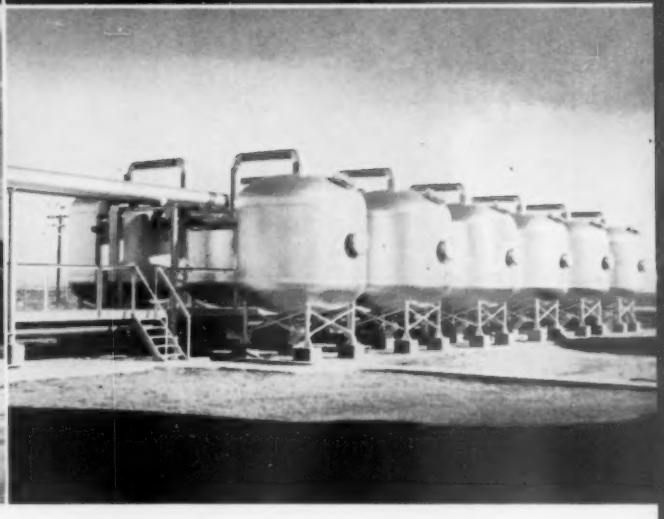

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YOUNGSTOWN knows it, too. That's why we pay particular attention to thread tolerances and joint make-up in the manufacture of all Youngstown Oil Country Tubing.

Youngstown Seamless Tubing—available in H-40, J-55 and N-80 grades—is produced with either non-upset or external upset ends. Youngstown quality-controls all its integrated operations from ore mine to finished product—which assures you long, trouble-free field performance.

When you need Tubular Engineering Service or additional information, contact your nearest Youngstown Sales Office. You will find our Field Engineers as near as your telephone. Why not call today?

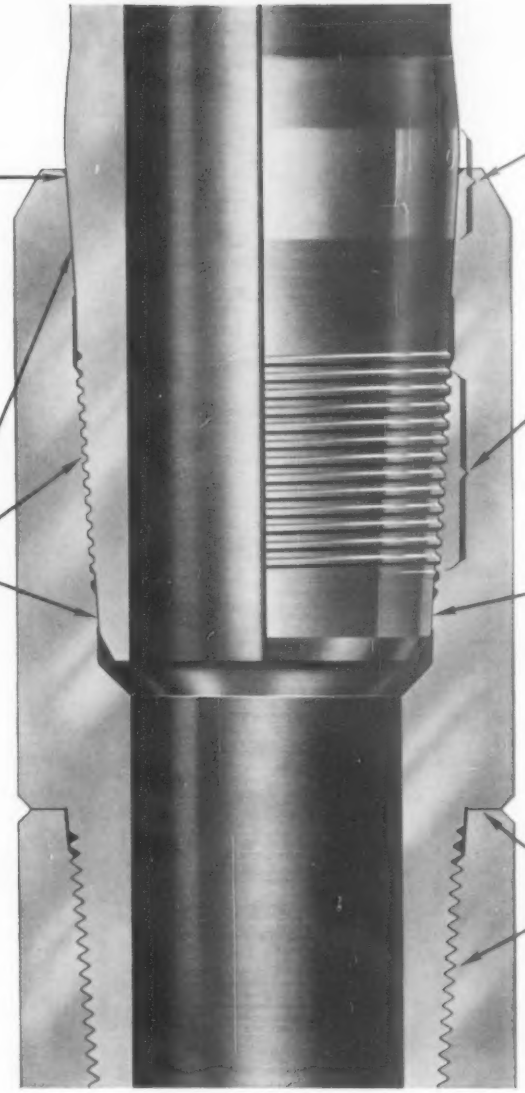
QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices - Youngstown 1, Ohio

District Sales Offices in Principal Cities



Steel taper permits thick section at point of last contact between pipe and tool joint where bending loads in pipe are greatest.

This critical area of the pipe is **cold-rolled** at the mill for greater strength, using equipment and techniques developed by Hughes engineers.

Engaged thread strength in shear is greater than two times the strength of the drill pipe.

All mating surfaces — the outer seal, pipe threads, and inner seal — are on the same taper. This provides uniformity of fit on initial and replacement installations.

Nose seal is on taper to assure uniformity of fit and positive seal against leakage, on both original or replacement installations. This prevents corrosive fluids attacking threads.

The three points of engagement of the "Seal-Grip" joint provide a FRICTION GRIP stronger than the torsional strength of the pipe.

Copperplating of threads and shoulders of Hughes tool joints protects against scoring and galling.

Hughes offers improved SEAL GRIP assembly

The process and equipment developed by Hughes for cold rolling the large land area of the drill pipe at the pipe mill produce a superior "Seal Grip" assembly unequalled in strength and dependability.

In laboratory fatigue tests—*where pipe is run to destruction*—we have not been able to induce a single failure in the cold-rolled area of the pipe. This added feature plus superior design makes HUGHES "Seal Grip" today's best buy in replaceable tool joints.

HUGHES TOOL COMPANY

Developers of "Flash-Weld," "Seal Grip" and Counterbore Weld Tool Joints